THE WEB-BASED SLA MONITORING AND REPORTING (WSMR) SYSTEM

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Abstract: To provide high-level quality of network service and prevent contract dissension, a Service Level Agreement (SLA) is an essential key factor in telecommunication industry. While most network service providers normally offer an SLA communicating with legacy monitoring or reporting systems, it is needed to suggest new architecture of an SLA system for accommodating legacy network management systems without considering operating environment of each system. To guarantee level of network service, it is important to gather raw data from legacy systems or other Operating Support Systems and exactly manage it in time. In this paper, we suggest architecture of an integrated SLA system that is operated on the web-based communicating technology with legacy systems, i.e. Web-based Service Level Agreement Monitoring and Reporting (WSMR) system. The proposed architecture offers the way to gather raw data and process it using web-based communicating technology.

1 INTRODUCTION

As growing of Information Technology (IT) industry, Internet Protocol (IP) is a de facto telecommunication technology instead of Asynchronous Transfer Mode (ATM) or Frame Relay (FR). IP is designed to transfer data from one site to others without complicated technologies and the simplicity of IP has explored the size of IT business. While Quality of Service (QoS) is considered as a minor factor to communicate in the early of network era, there is a requirement of accurate quality of network service depending on the business rules from both Network Service Providers (NSP) and customers.

Among these efforts to improve network service quality, the concept of Service Level Management (SLM) is emerged. SLM is the disciplined, proactive methodology and procedures used to ensure that adequate levels of service are delivered to all (IT) users in accordance with business priorities and at acceptable cost. And the instrument for enforcing SLM is Service Level Agreement (SLA) (Rick Sturm 2000).

An SLA emerged in the early 1990s as a way for Information Technology (IT) departments and service providers within private (usually, corporate) computer networking environments to measure and manage the QoS which they were delivering to their internal customers. Service level agreements are the contractual component of QoS and are usually implemented as part of a larger service level management (SLM) initiative (John J. Lee 2002).

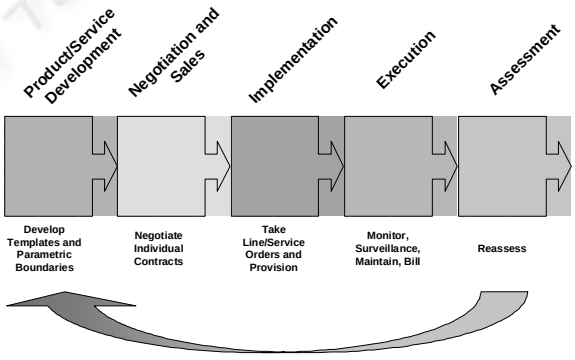

Figure 1: Service and associated SLA life cycle

An SLA is a formal negotiated agreement between two parties. It is a contract that exists between the Service Provider (SP) and the Customer(TM Forum, 2001). In the view of NSPs, a SLA let them have a chance to control and manage their whole network resource more precisely. There are five phases used to analyze SLA management; Product/Service Development, Negotiation and Sales, Implementation, Execution and Assessment as

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shown in Figure 1. When developing an SLA, consideration must be given to the life cycle as it may affect SLA requirements(TM Forum, 2001).

2 RELATED WORKS

To Implement and execute a SLA, there are a lot of attempts to propose a framework for constructing and managing quality-of-service (QoS)-centered service level agreement (SLA) between service providers and their customers. In these attempts, SLA is provided through the off-line designing steps and real-time SLA management steps which are good solutions to provide real-time SLA in multi-service packet networks (Eric Bouillet, 2002). However, there is also needed to gather information from other legacy systems to provide several SLA.

To communicate with legacy systems for collecting information, there are some of trial efforts to use legacy monitoring or reporting systems for SLA monitoring and reporting. One of these is an integrated Customer Network Management (CNM) architecture. This architecture provides SLA with extending legacy CNM concept. In this architecture, all functional modules are designed and implemented as a CORBA object and it adapts COM/CORBA communicating mechanism (E.C. Kim, 2000). While COM/CORBA communication provides the way to access objects, it is easier to transfer XML via Simple Object Access Protocol (SOAP).

Recently, as growing web service technologies, XML web services architecture is recommended and used when there is a need to communicate with each other. One of the primary advantages of the XML Web services architecture is that it allows applications written in different languages on different platforms to communicate with each other in a standards-based way (Roger Wolter, 2001). Also, all of network services do not have a common network specification and many research groups or telecommunication companies have tried to categorize and classify the SLA metrics to provide adaptable SLA to network service providers and their customers (Nathan J Muller, 1999).

In this paper, we suggest the web-based SLA system, i.e. WSMR system, depending on the XML Web services architecture. This paper is written in the following steps. In section 3, we suggest architecture of WSMR system and explain the components of WSMR system. It shows the result of experimental test of WSMR in section 4. In section 5, we mention about the conclusions and present the further works.

3 WEB-BASED SLA MONITORING AND REPORTING (WSMR) SYSTEM

To support an SLA, it is important to categorize all of contract elements because of managing and controlling easily. There are normally three categories in the SLA.

The first SLA category is Open Metrics. Open Metrics is related with a process that checks whether NSP provides network service in time or not. If there is a delay of open service, SLA system has to monitor the open process, verify the violation of open metrics and notify NSP and customers of the violation.

The Second is Trouble Metrics. Trouble Metrics is related with a process which monitors how long NSP spends a time to recover network trouble and how many times it has been occurred during charging period.

The third is Performance Metrics. Performance Metrics is the important metrics category in the view of IT business. Performance Metrics is related with QoS of network and there are many testing methods in various network services.

In the case of world leading IT companies, some of them present several performance metrics that are network latency, packet delivery, network availability and so on (MCI).

The WSMR system has been designed and developed to provide and manage a contract between network service providers and their customers based on the web-based XML technology. In WSMR system, it is communicating with each network performance gathered system for collecting network performance data and monitoring network performance data which is produced by Data Statistic Module (DSM) in WSMR every midnight.

To receive raw data, a WSMR system has to communicate with other OSS systems periodically, i.e. Customer Open Processing (COP) System, Customer Service Guarantee (CSG) System, each Network Management System (NMS) and Equipment Control (EC) System. The COP system manages customer open request and The CSG system controls and manages every network trouble data. NMS manages the status of network and the EC system manages network equipments. To consider these conditions, we design WSMR system consisted of communication module as shown in figure 2; data management module, data statistic module, monitor module, data gathering module, service specific processing module.

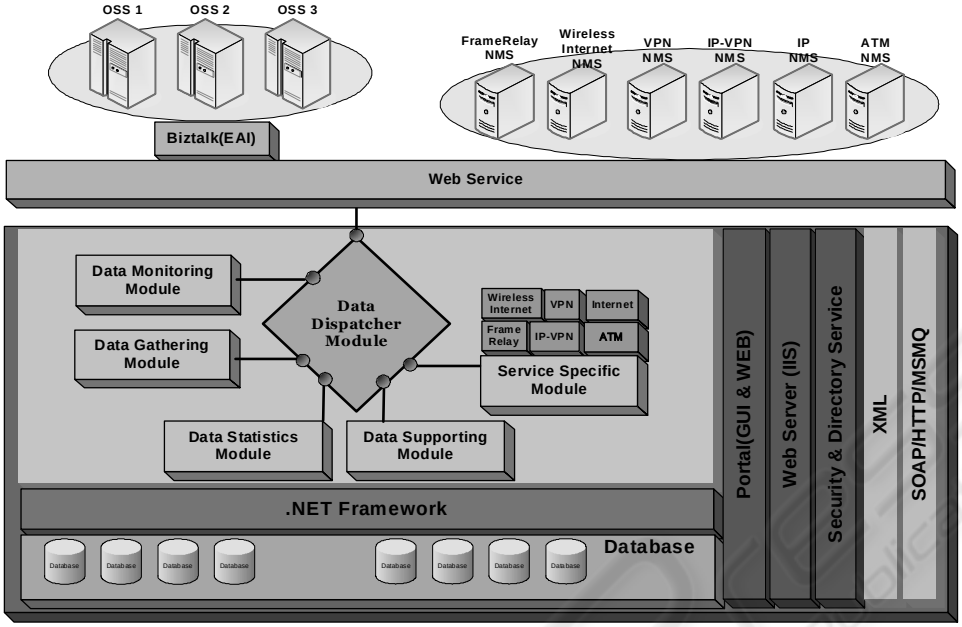

Figure 2: The components of WSMR system

To communicate with other systems, WSMR system uses XML which is one of standard to present the documentation in different telecommunication environment to persistent data consistency and accuracy. Each XML document has specific attributes which are able to distinguish it from other documents. Using specific attributes, the WSMR system verifies and manages raw data from other systems.

3.1 Data Dispatcher module

The main role of DDM is control and management of raw data depending on the individual case because there are many systems which have their own operating environment and specific operating process.

The first role of DDM is providing communication interface to other OSS systems or NMS systems with web-based communication technology.

To support web-based communication, DDM defines web interfaces using Web services Description Language (WSDL) and registers these interfaces in the Universal Discovery Description and Integration (UDDI). Through pre-defined web interfaces, DDM communicates with other systems based on the XML-based Simple Object Application Protocol (SOAP). With these technologies, we do not consider the environment of each system but just define the interworking XML data format.

The second is translating external data into internal common data format. In the case of open metrics, each NMS interworked with WSMR system has its own open data format. In the view of WSMR system, if WSMR system accommodates a new network service, each module of WSMR system redefines all of process for the new network service. So, it is overhead process to every modules depended on the each open data format. To translate original data format into internal common data format, operator has to register mapping information in the following steps;

- Define common data format
- Check original data format
- Select elements from original XML document
- Decide mapping rules
- Register mapping information

Through above 5 steps, it is possible to use common data format in the WSMR system while an original data format is various.

The third is transferring raw data to target modules depending on the mapping information which is managed by SLA operator in the DDM. Transferring function is worked through queue pool which is controlled by queue management block as shown in figure 3.

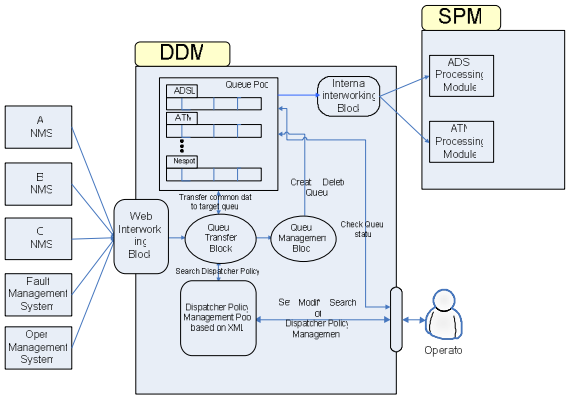

Figure 3: The structure of data dispatcher module

3.2 Service Specific Module

The Service Specific Module (SSM) checks contents of XML document and retrieves information from it what SSM has to control. In the case of processing open metrics, SSM saves information using library provided by Data Supporting Module (DSM) in the WSMR database.

In the case of receiving Open Completed Order or Open Changed Order, SSM finds out initial open order which is related with the received order. If there is any unmatched information in the Open Completed or Open Changed Order, SSM throws it to the DSM to save log information of error.

Also, SSM sends it to the service-specific process web service if there is a need to process service specific control. In that case, SSM receives the result of processing service-specific process web service and request DSM to save the information and log. In the processing of open metric, it is important to keep the status of processing each customer and SSM manages it.

Because WSMR system has to accommodate network service dynamically, we design that SSM consists of common web service part and service specific web service part. So, if WSMR system receives a XML document, SSM checks the type of XML document, finds out the mapping information in the XML creation web service list table and calls related web service for processing service specific scenario. Otherwise, if there is no need to use a web service, SSM deletes a web service that is no more used

3.3 Data Supporting module

Data Supporting Module (DSM) provides libraries related with Data Base to other modules in WSMR system. In WSMR system, there are a lot of information from other systems and are many database tables depended on the type of information. So, if there is allowed to access database directly, every access routine has a dependency on the status of database tightly.

Because it is inefficient policy that all of modules in WSMR system control database individually, we design the module that wholly controls database to guarantee information consistency in database. Using DSM, it is easy to access data base without considering the structure of DB table or other things and possible to access database efficiently.

3.4 Data Monitoring Module

The WSMR system monitors all information related with SLA metrics and forecasts the violation of contract between two parties. If there is a sign to violate the contract, WSMR system alarms it to the operator or other systems that control each network.

To support these operations, DM (Data Monitoring) module monitors periodically all of data which are saved in data base. The standard value of each metrics is already saved in metric table before WSMR system supporting network services.

To monitor all of information is very difficult, so DM module has a monitoring policy which is based on the time when each data occurred and generated by SSM.

3.5 Data Statistics module

DST (Data Statistics) module generates statistic information. The statistic units are day, week and month because normal billing unit is month. In statistic information, there are two types. The first type is general information which is needed to represent the state of WSMR operation. The other type is specific information that is used to manage Trouble or Network metric. When WSMR system checks and finds out whether there is a violation or not, statistic information produced by DST module is used.

Because it is not necessary to operate all day long, DST module works on every midnight to generate statistic information based on gathered information which is collected.

3.6 Data Gathering module

In providing an SLA in WSMR system, WSMR system has to gather bulk data from other systems. The amount of bulk data is very huge and each interworked system has its own interworking method. Considering these conditions, we design

DG (Data Gathering) module which has a charge to gather information with adapting individual interworking method instead of ID module. There are several types to communicate with other systems, i.e. NMS. DG module provides a container which accommodates interworking sub-modules

4 THE RESULT OF EXPERIMENTAL TEST

In this paper, we set a test server to test the performance of WSMR system; P4 2.8GHz * 8, 32G Memory, Windows XP professional, generate incoming raw data and increase it.

As shown in figure 4, the processing time is not related to the number of concurrent incoming raw data. From a case of 500 up to 3000 incoming data, the processing count in a second is climbing up but the count is climbing down over 3000. In the result of test, we know that the default processing time is needed whether concurrent count is many or not. Over 10000 counts, the processing capability is stabilized and the WSMR system is more adjusted large scale processing conditions.

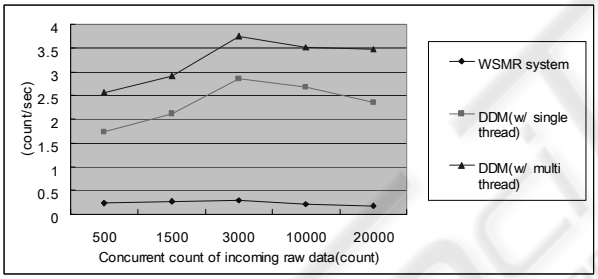

Figure 4: The experimental result of the WSMR system and DDM's performance

5 CONCLUSIONS

In the early of 2000s, there are several suggestions of providing SLA in the view of several ways. One of them is QoS-centered SLA architecture and the other is a legacy-extension architecture depended on the extension of legacy reporting or monitoring system. In these suggestions, there is no way to communicate with other Operating Support Systems which don't provide specific interworking technologies like CORBA. To overcome this problem, this paper provides architecture of SLA system which is operated on a web-based communication technology to communicate with other systems which are operated in the different operating environment.

Supporting SLA means to report or monitor the status of network service quality in time for each network service customer and if there is no way to provide SLA in time, SLA function doesn't have its right role. To provide in-time service, it is needed to build several modules to manipulate raw data and transfer it to target modules.

This paper design and develop the WSMR system which is consisted of several blocks to manipulate raw data in times.

In the future, we will design not only web-based communication mechanism but also other type of communication mechanism.

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