Evaluating the Effectiveness of Multi-Web Services in Load Balancing Cluster-Based Web Server

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INTRODUCTION

Web Service (WS) provides a flexibility platform for delivering computational task as service. Its architecture supports deployment of grid computing, Internet of Things (IoT) based applications and distributed computing in a flexible manner. The interoperable features of WS deployment support the homogeneous and heterogeneous communications among software modules.

It follows the principles of Service Oriented Architecture (SOA). The principles of SOA focus the methodology of service publishing, consuming and discovering over public registries. It supports service reuse and integration of additional service. The SOA is not limited to a technology. It can be implemented through the variety of programming languages, technologies and communication protocol. The power of Extensible Markup Language (XML) provides a framework in SOA for establishing communication among different business nodes. Recently, WS has become attractive paradigm for building the Software as a Service (SaaS). It is defined as SaaS for machine to machine interaction over different network topologies. The SOA offers the features of adaptability over different network connection and capabilities of terminals.

The principles of interoperability, reusability and modularity can be deployed through the methodology of WS. However, number of concerns and challenges are observed for the quality of the service (QoS). The QoS aspects can be observed from the perspective of service providers and consumers stakeholders. The service providers primarily concern about proper execution and implementation aspects of the service. Conversely, the service consumer primarily concerns about the quality assurance of the service. The service consumers also identifies whether the service is the right service for their business process or not. The service consumers usually identify the service over public service registries. The service can be executed and discovered at run time. Based on the functional parameter and business decision model, the consumer accesses the functionalities of the service. The service consumer is termed as WS client that can communicate the service provider and provide the additional service along with the existing service.

Many practitioners have been trying to deploy WS to deal with distributed business processes. Many prominent software industries are deploying their business services through the paradigm of WS architecture. Their primary goal is to deliver better and enhanced service to end users. With rapid growth of internet users, the consumer of WS is also increasing exponentially. As a service owner of WS, the

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primary concern is to deliver the service to massive users even in high stress of usage. However, the load balancing cluster based web server can play a vital role for handling massive users of WS. The clustering methodology of web server using single or multiple machines can deliver reliable and efficient service to end users. With rapid growth of organizational infrastructure and independent service delivery modules, the deployment of multiple WS and assessing their effectiveness is becoming crucial among software practitioners and researchers. As such, the QoS against high load of users is becoming an important concern among research community. This work will introduce a novel QoS assessment framework for evaluating the effectiveness of multi WS deployment using load balancing cluster based web server.

BACKGROUND

WS provides the platform as framework for deploying software agents as service over network and enhances the functional execution of business process. It utilizes the different loosely or tightly coupled software services for business logics (BL). It provides conceptual as well as programmable interface for integration of modular oriented functional logic in a respective service (Matthew et al., 2005). The consumer of WS is not aware of internal data structure and the service platform that it is executing. The consumer simply utilizes the WS for the computational BL. The overall service that executes in server side and delivers service over network based protocol is termed as Service Oriented Computing (SOC). However, based on service delivery scenario and BL, the SOC based system may utilize the deployment of single or multiple WSs for service delivery. The SOC based system primarily utilizes SOAP, Web Service Description Language (WSDL), and Universal Description Discovery and Integration (UDDI). The software agents communicate through SOAP messaging that contains Extensible Markup Language (XML) nodes (SOAP, 2016). The publicity of the service is highlighted through WSDL file of the service. It establishes the connectivity and generates necessary server side files in client side (WSDL, 2016). The UDDI is the platform that showcases the required functional parameters of the service (Peiris et al., 2007). The block diagram of SOC based system and the different ways of WS communication are discussed elsewhere (Bora et al., 2016).

The SOC usually provides a framework for implementation and delivery of software agents, business process and logics over network based protocol. The SOC based model presents WS as loosely or tightly coupled software agents. It allows to present service as parent, broker or consumer of other service. Here, the consumer of service usually not aware of internal architecture of software agent being deployed. Their operational execution supports XML processing. The power of SOAP, UDDI and WSDL is being deployed for inter WS communication.

The WS can play the role of consumer, parent service (PWS) and child service (CWS). The WS can deliver services over network only through the web server. The web server processes the incoming Hyper Text Transfer Protocol (HTTP) request and delivers it to respective WS class files. Many researchers observed that (Saddik, 2006; Kalita et al., 2011; Bora et al., 2013; Bora et al., 2014), web servers have some limitations while handling massive request. Beyond a specific limit it fails for processing incoming request. However, the utilization of load balancing cluster based web server can enhance the processing capacity of web server up to a limit (Bryhni et al., 2000). The load balancing cluster based web server can be deployed through single or multiple machines. Different nodes can be created in the web server that can execute similar service for the end users. As such when a particular node fails in processing incoming HTTP request, the load balancer redirects it to other active nodes. The load balancer continuously validates whether the particular node is working with heavy load or idle in processing. As such