ABSTRACT

Quality of service plays an important role in distributed systems. Cloud computing has been the recent entrant to the distributed system market and has revolutionized computing by changing the way computing resources are accessed and paid for. Users can access cloud services and pay only for the usage similar to utilities. Trust computing systems can be employed for identifying the service providers quality in terms of their adherence to the committed in SLAs. Several trust computing mechanisms have been proposed in literature based on various algorithms and functions. Almost all of them are based on a single performance parameter and modify the trust scores monotonously when performance deviations are reported. This paper proposes a trust computing mechanism that statistically validates the attribute monitored before modifying the trust scores. Hence the proposed mechanism is protected from momentary fluctuations in system performances. The experiments conducted show that the trust scores computed using the proposed mechanism are more representative of the long term system performance than the ones that were computed without the validation of the inputs.

Keywords: Cloud Computing, Multi-Dimensional Trust Computing, Service Level Agreement (SLA), Statistically Enhanced Trust Computing, Trust Management

INTRODUCTION

Cloud computing has been identified as the 5th utility in the line of electricity, water, gas and telephony (Buyya, Yeo, Venuopapol, Broberg, & Brandic, 2009). Typically what is common all the utilities is that the clients can access the resources as services irrespective of the where the source is and how it has been delivered to them. Also the clients would only be required to pay for the services (resources) accessed or consumed. The complexity of delivery network is transparent and usually of no concern to the end users. Similar to the other utilities, cloud
computing envisages to make computing a utility by enabling the users to access computing resources including hardware, operating platform and software as services over the Internet. Since the introduction of cloud computing to market, the market has been flooded with several cloud service providers (Rimal, Choi, & Lumb, 2009). These cloud providers host their services on the Internet and make them available to users. Depending on the physical resources available at the service providers, quality of the connectivity and the number of concurrent users accessing the services the service quality experienced by the clients would vary from one provider to another. The client enters into a Service Level Agreement (SLA) with the service provider prior to any service has been consumed (Wu & Buyya, 2012). The SLA formally declares the conditions to be met by both parties and penalties to be imposed, in case of breaches or failures. The level of service or service quality is one of the most important conditions to be met by the service providers. The SLA typically includes the technical definitions of service level parameters such as availability, response time, throughput, delay, jitter, failure times and the acceptable values for these parameters in terms of maximum, minimum or mean depending the parameters and their criticalities (Wang, Wang, Wang, Chen, & Santiago, 2007).

According to Garg, Gopalaiyengar and Buyya (2011) transactional applications such as web services where real time performance is a major concern demand faster response time and throughput guarantee whereas as non real time batch jobs including offline database synchronization, payroll systems etc., are mainly concerned with job completion time and accuracy. Thus the selection of the right parameter(s) for measuring and quantifying the service level or quality is dictated by the type of application. Not only the type of parameters used for measuring the service quality is important in measuring the service quality, the values assigned to them also play a vital role. Turnbull, Jensen and Smith (2000) carried out a research on the quality of service requirements of internet service provision of various class of customers and found that the QoS requirements of established Small and Medium Enterprises (SME) were more stringent than that of startup companies, home based workers and casual family users. They also found that the stringency for service quality varies from very strict to relaxed from SMEs, startup companies, home worker to family users respectively. The reason for this variation was found to be the nature of use and the criticality of the connection to the main operations of the individuals concerned. Hence it can be concluded that the businesses are more stringent on service quality than individual users. Letia and Marginean (2011) state that the difference between a client’s expectation and what he perceives he receives affects the perceived quality of the service. Smaller the difference, better the quality of service. Guazzone, Anglano and Canonico (2011) state that the goal of a cloud infrastructure provider is maximizing profits by minimizing the QoS violations and lowering infrastructure costs. QoS violations affect both service provider as well as clients as service providers will have to incur penalties for violating the agreements, while the clients’ applications will suffer due to lack of resources. If the client is a business client who uses the cloud resources purchased to host their business applications, the services to his customers will suffer reducing his profit margins. Hence customers would prefer service providers who could meet the QoS requirements agreed upon the SLA rather than he would tend to violate them. Marilly, Martinot, Papini and Goderis (2002) have identified the following requirements with regard to QoS from a customer expectations perspective:

- Reliable measurement of the quality of services;
- Provision of the expected quality of services;
- Optimization of the resource usage.

Thus an automated system that could track and quantify the QoS of service providers would come in handy from a customer point of view.
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