SLA Violation Detection Mechanism for Cloud Computing

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ABSTRACT
Cloud computing is a general term for anything that involves delivering hosted services over the Internet. It is a construct that allows you to access applications that actually reside at a location other than your computer or other Internet-connected Device. Service Level Agreement (SLA) is a document that includes a description of the service, service level parameters, guarantees, and actions for all cases agreed. The SLA is very important as a control between consumer and provider for any violation for the agreement. In several cases cloud provides violate the level agreement with clients and provide the service at a less level than what has been agreed to. To tackle this problem this paper proposed SLA –based violation detection mechanism for resource allocation for cloud computing based on the number of allocated processors. To examine the proposed mechanism we conducted a simulation experiments using CloudSim simulator. The experiment has two scenarios, the first scenario the number of resources (virtual machine) is greater than the number of resources requested by the submitted jobs (cloudlet). The second scenario shows SLA violation as the number of processors provided by the cloud providers is less than the requested number of processor by the jobs or cloudlet. Results revealed that the proposed SLA mechanism has the ability to detect the violations for the SLA agreement.

Keywords
Cloud Computing; SLA; Violation

1. INTRODUCTION
Cloud computing emerged as a new computational model to replace the traditional computing model and satisfy the increasing demand for the resources, software and infrastructures. Cloud Computing is fully new computing model appeared in the 21st century[1].Cloud computing is defined as an on demand service in which shared resources, information, software and other devices are provided according to the client's needs at specific period of time[2].

Developing and maintaining on-premise software consider a complex, costly, and risky task. All software needs hardware, an operating system, a database and Web servers. Once the requirements were provided, a group of developers had to find complex programming framework. Furthermore, A group of network, database, and system management experts are required to keep everything up and running. Unavoidably, a business need would require a change to the software, which would then start a long building, test, and redeployment cycle[3].

Big companies often needed particular facilities to house their data centers. Massive amounts of electricity also were needed to power the servers and the systems to keep them cool. Moreover, a backup site is needed to mirror the data centers to replace them in case of disaster.

NIST defines Platform-as-a-Service as: "The capability provided to the consumer to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, APIs, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment".

2. CLOUD SERVICE MODELS
Three different types of cloud services are available for cloud clients as described in the following subsections.

2.1 Software as a Service (SaaS)
Software as service provides typically specific, already-developed applications running on a cloud infrastructure. A very famous SaaS is the web-based e-mail.

Most software cloud computing services are web-based applications, which can be accessed from different client nodes using a thin client interface, such as a web browser. The clients of software as service cloud do not manage or control the underlying infrastructure and platform; only limited user-settings are available for the customers[4].

2.2 Platform as a service (PaaS)
Platform as a service cloud offer a managed higher-level application infrastructure, where clients can create and deploy particular types of software and services using the tools, environments, and programming languages supported by the cloud provider. The offers include the use of the underlying infrastructure, such as servers, network, storage, or operating systems, over which the customers have no control, as it is abstracted away below the platform[5].

2.3 Infrastructure as a service (IaaS)
Höfer in[4] described IaaS as "Cloud infrastructure as services in general provide virtualization platforms, which are an evolution of the virtual private server offerings, which are already known for years. The customers buy the resources, instead of having to set up servers, software, and data center space themselves, and get billed based on the resources consumed. They deploy their own software on the virtual machines and control and manage it. The virtual instances can be rented for as long as necessary, which can be as short as an hour"[4].

3. SLA FOR CLOUD JOB ALLOCATION
A service level agreement is a contract that contains a description of the arranged service. Service level agreement is a guarantees and actions for all types of service violation. The SLA for cloud computing is so critical as it represent a contract between cloud clients and the cloud service provider. The basic aims of SLAs is to provide an obvious definition of

the formal agreements about service terms like performance, availability and cost[6].

Several Internet service providers (ISP)s supply their clients with an SLA. In recent times, information technology departments in most enterprises have taken on the idea of conducting a service level agreement so that services for their clients can be measured, justified, and may be compared with those of out sourcing network providers [7].

Client request cloud servers to supply service at certain level Nevertheless, in numerous situations the cloud service provider violate this level .There is a need for a good SLA based violation detection mechanism for Resource Allocation for cloud computing.

This research aims to propose an SLA–based violation detection mechanism for resource allocation for cloud computing based on number of allocated processors.

4. RELATED WORKS

Several researches have been conducted to tackle the SLA issues in cloud computing. The researchers in [8] proposed , a quality of service mechanism on cloud computing based on SLA model. They introduced a new language to describe QoS-oriented SLA associated with cloud services [8].

The works in [9] introduced a new model for the resolution of a problem of choice between alternatives, when several contradictory points of view must be taken all together in consideration. They explained the implementation of the proposed model inside Cloud agency.

The research in [10] proposed a new resource allocation mechanism for SaaS providers who want to reduce infrastructure cost and SLA violations. The mechanism is designed in a way to guarantee that SaaS cloud providers are able to manage the dynamic change of customers, mapping client's requests to infrastructure level parameters and tackling heterogeneity of Virtual Machines.

Xiaoyong, et a[11] presented a cloud SLA availability commitment framework together with availability calculation and penalty calculation methods. Their paper has compared SLAs of well-known public IaaS cloud providers with investigation of their merits and defects. In addition the produced a business framework for cloud providers to get the best penalty degree for their SLAs, which will help in determining availability based SLA of cloud services.

5. THE PROPOSED SLA MECHANISM

The purpose of the proposed SLA violation detection mechanism is to ensure that the proper elements and commitments are in place to provide consistent IT service support and delivery to the customer(s) by the service provider(s).

The proposed SLA mechanism is assuring and verifying the number of processors allocated to the client are conformed to the agreement and that the service providers are committed to applying the agreement.

5.1 The proposed Algorithm

Begin

Determine number of cloud user

Create DataCenter with host.

Create Broker

Create VM

Create cloudlet

Create container to store VM

Description VM parameter

Add VM to list

Description cloudlet parameter

Add cloudlet to list

Add PEs to host list

Begin if

Broker ← cloud resource list received with 1 resource

Broker ← trying to create VM in DataCenter

Broker ← VM has been created in DataCenter

Broker ← sending cloudlet to VM

Broker ← cloudlet received

Broker check:

If all cloudlet executed

Then Print "output simulation"

Else

Print "unwanted errors happen"

End If

Broker receive number of Processors requested by cloudlet

Broker allocate Processors to the cloud let

The propsed mechanism check:

Begin if

if pesvm>= pescloudlet

Output " no sla violation"

Else

Output " sla violation"

End If

5.2 Details of the proposed Mechanism using Flowcharts

The proposed SLA detection mechanism aims to provide a method that enables the cloud clients to detect the violation of the provider services. The main idea of the proposed mechanism is based on the allocation process of cloud processors to the client jobs as many cloud provider provide the clients with a number of processors less than what the have requested. As shown in Fig 1 the proposed SLA detection mechanism check the number of processors allocated by the broker to client job and compared this number with requested number of processors by the client jobs to detect any violation for the agreement.

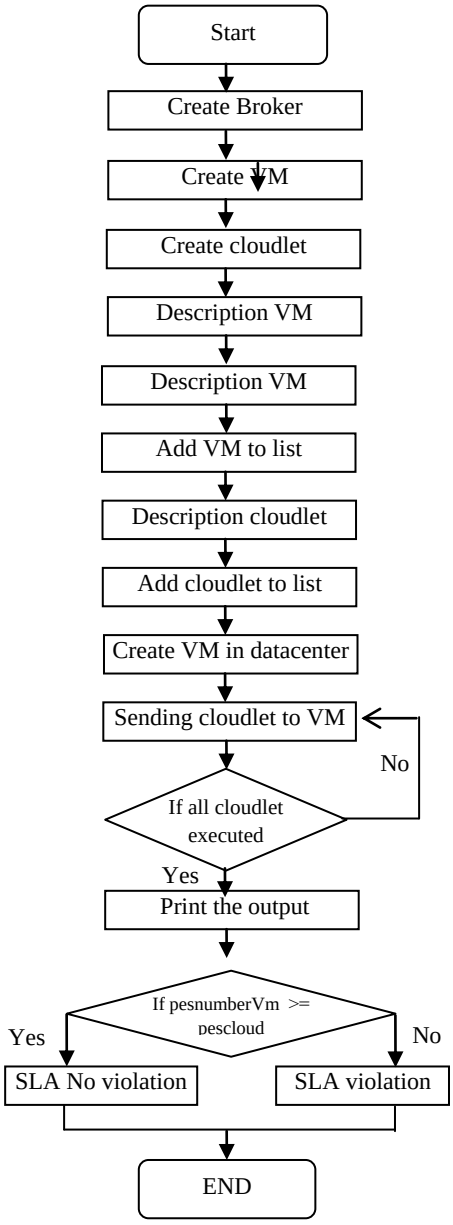

Fig 1: Flowchart of the Proposed SLA Mechanism

6. EVALUATION AND RESULTS

To examine the proposed mechanism this research conducted a simulation experiment. The experiment has two scenarios the first scenario the number of number of resources (virtual machine) is greater than the number of resources requested by the submitted jobs (cloudlet).The second scenario show SLA violation as the number of processors provided by the cloud providers is less than the requested number of processor by the jobs or cloudlet.

6.1 The First Scenario

Test number processor Vm allocated is greater than processor number cloudlet requested then No SLA violation.

Table 1. The First Scenario

No of VMs Allocated	Status	No of VMs request by Cloudlets
16	No SLA Violation	15

========== OUTPUT ==========

CloudletId	STATUS	DatacenterID	VmId	Time	Start Time	Finishtime	Results
0	SUCCESS	2	0	300	0.2	300.2	noViolation
1	SUCCESS	2	0	300	0.2	300.2	noViolation
2	SUCCESS	2	1	300	0.2	300.2	noViolation
3	SUCCESS	2	1	300	0.2	300.2	noViolation

Fig 2: The First Scenario

As shown in Fig 2 and Table 1, the proposed mechanism in this scenario found out that the broker has allocated 16 processors to the client job while the client was requested 15 resources as minimum. Therefore, there is no violation for the SLA agreement.

6.2 The Second Scenario

Test number processor Vm allocated is less than processor number cloudlet requested then SLA violation.

Table 2. The Second Scenario

No of VMs Allocated	Status	No of VMs request by Cloudlets
14	SLA Violation	27

========== OUTPUT ==========

CloudletId	STATUS	DatacenterID	VmId	Time	Start Time	Finishtime	compare
0	SUCCESS	2	0	617.14	0.2	617.34	Violation
1	SUCCESS	2	0	617.14	0.2	617.34	Violation
2	SUCCESS	2	1	617.14	0.2	293.53	Violation
3	SUCCESS	2	1	617.14	0.2	293.53	Violation

Fig 3: The First Scenario

As shown in Fig 3 and Table 2, the proposed mechanism in this scenario found out that the cloudlet requested 27 processors. However, the broker allocated the cloudlet only 14 processors. Therefore, the proposed mechanism declared an SLA violation state.

7. CONCLUSION

In several cases cloud provides violate the service level agreement with clients and provide the service at a less level than what has been agreed. To tackle this problem this research proposed SLA violation detection mechanism to detect and discover any violation of the level of the providers and clients. The proposed mechanism has successfully discovered the violation of the SLA agreement. We see many avenues of future research in this area. One such avenue is based on scalability, which is considered an important aspect of cloud computing. Clouds however may not be able to scale inde_nitely and when a resource limitation is encountered, a service provider may decide to delegate the tasks to other cloud providers, transparent to the consumer to avoid significant SLA violation penalties. Such a scenario creates research opportunities in SLA management. We anticipate investigating SLA aspects such as accounting, monitoring of QoS parameters and condition violation in similar scenarios as future work

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