Sla-Based Autonomic Cloud Resource Management Framework by Antlion Optimization Algorithm

Bhupesh Kumar Dewangan, Amit Agarwal, Venkatadri M, Ashutosh Pasricha

Abstract: ***Service level agreement SLA is a key to attract the user to opt service from the cloud. The quality of service QoS and SLA plays vital role towards the trust to use the services of any application/infrastructure. If SLA violation rate is high then it directly affect to cost and user distraction. In this paper, we have done state-of-art survey on various SLA-aware resource management frameworks and obtain the different objective function and the utilization percentage from year 2014 to 2018. The objective of this paper is to propose SLA-based autonomic resource management technique SMART through antlion optimization algorithm to maximize the resource utilization based on SLA and QoS satisfaction. The execution time, cost and SLA violation rate, objective functions computed for this framework and compare with two existing frameworks. The framework is implements in cloudsim toolkit and the results recorded the utmost performance. The experimental results confirm that cost, execution time, and resource cost are increasing while SLA violation rate is increasing.***

Index Terms-Autonomic Computing, Resource Management, SLA Violation Rate, Resource Utilization.

I. INTRODUCTION

Resource management in cloud computing is one of the key area for researcher, it affect the cost and user trust too. Due to huge demand of cloud services and massive request submission by cloud user, the large number of datacentre and servers need to be install. The massive request can be process through resource management frameworks existing to the cloud service provider CSP, but it may slow in process due to human intervention. To avoid such issues, autonomic resource management is required.

Consequently, with the end goal to accomplish the CSP goal to amplify benefit and consumer loyalty levels, our work proposes practical mapping and planning approaches, which limit cost by improving the resource allotment inside a virtual machine VM. These approaches additionally consider QoS parameters, and framework heterogeneity with respect to different kinds of VMs and different execution time, and resource cost. To fulfil client's demand with the end goal to the following issues mentioned:

- How to manage the resources based on customers request?
- How to maximize the resource utilization?

The organization of the paper is as follows: In section II, we have discuss the various SLA based frameworks with objective function utilization, and compared all the frameworks based on objective functions. The section III focused the issues of SLA based resource management frameworks, where in section IV we have presented architecture and methods to resolve the mentioned issues. The section V is about experimental results and analysis with existing systems. Section VI concluded the overall paper and future work.

II. RELATED WORK

The survey of existing works has carried out based on cost, resource utilization, energy consumption, execution time, and QoS as follows:

A. Cost, Resource Utilization and Execution Time Based SLA-aware Frameworks

In this paper, authors [1] introduced client driven SLA-mindful asset administration figuring to limit cost by confining asset use and SLA infringement rateThe proposed provisioning estimations consider client profiles and suppliers' quality parameters to oversee dynamic client deals and structure level heterogeneity for gigantic business frameworks. They in like way consider client side parameters, and structure level parameters, to think about checks. Re-establishment results show that calculations lessen the aggregate expense up to 54 percent and the measure of SLA infringement up to 45 percent, separated and the starting at now proposed best figuring.

In this paper, authors [2] survey SLA-mindful VM organizing structures for cloud server farms. The association level targets considered are asset use and receptiveness. The model assets are CPU and RAM. They can be overprovision by the CSPs, or, as such use to broaden their wage. The accessibility of a VM influenced by moving it inside and between server ranches. To get sensible outcomes, they reproduce the impact of the systems utilizing the Federated CloudSim structure and true blue residual task bits of knowledge of business-major VMs.

Manuscript published on 28 February 2019.
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Their evaluation demonstrates that there are astounding complexities between the orchestrating techniques to the degree SLA Violations and the measure of advancements. From all systems considered, the mix of the Minimization of Migrations method for VM choice and the Worst Fit procedure for host confirmation accomplishes the best outcomes. Authors [3] present two novel VM-scaling figuring concentrated on dEIS structures, which ideally recognize most authentic scaling conditions utilizing execution models of passed on applications landed from unsurprising wonderful position waiting be done benchmarks, together with SLA-chose execution objectives. They copy the VM-scaling figuring in a cloud test system and separate against seek after based execution models of dEISs. They consider three SLA-based VM-scaling tallies in context of a valid application condition including a gigantic variable number of clients. The outcomes demonstrate that it is beneficial to utilize autoregressive farsighted SLA-driven scaling calculations in cloud association frameworks for ensuring execution invariants of scattered cloud applications, rather than utilizing just open SLA-based VM-scaling tallies.

B. QoS based SLA-aware Frameworks

In this paper, authors [4] handle the resource allotment issue inside a datacenter that runs distinctive sorts of use remaining burdens, especially non-intelligent and value-based applications. They propose a confirmation control and planning component, which amplifies the resource usage and benefit, as well as guarantees that the QoS necessities of clients met as indicated in SLAs. In their exploratory examination, they observed that it is essential to know about various kinds of SLAs alongside appropriate punishments and the blend of remaining tasks for better resource provisioning and use of datacenters. The proposed instrument gives generous change over static server combination and diminishes SLA infringement. Authors [5] investigation fixates on successfully arranging Cloud assets for BDAAs to satisfy Quality of Service (QoS) necessities of spending plan and due date for data logical requests and open up advantage for the AaaS organize. They propose an affirmation control and asset arranging figuring, which not simply satisfies QoS requirements of sales as guaranteed in Service Level Agreements (SLAs), yet moreover extends the advantage for AaaS providers by offering a monetarily wise asset booking game plan. They propose the design and models for the AaaS stage and lead tests to survey the proposed count. Results show the profitability of the computation in SLA guarantee, advantage update, and cost saving. Authors [6] give a space particular dialect that permits to portray SLA in cloud administrations. They present a general control-theoretic methodology for overseeing cloud benefit SLA. They apply our methodology on MapReduce, locking, and internet business administrations. Authors [7] present SLA-Aware-autonomic-asset organization system called STAR, which generally fixates on diminishing SLA encroachment rate for the capable transport of cloud organizations. The execution of the proposed strategy has surveyed through cloud condition. The exploratory results show that STAR is profitable in diminishing SLA encroachment rate and in improving diverse QoS parameters, which influence successful cloud advantage movement.

C. Energy Based SLA-aware Frameworks

[8] Propose a SLA-mindful essentialness capable booking plan, which designates legitimate proportion of assets to MapReduce applications with YARN outline. In this booking methodology, writers consider the data region information to save the MapReduce arrange development. In addition, the slack time between the genuine execution time of completed endeavors and expected fulfillment time of the application used to improve the imperativeness profitability of the structure. An online userspace agent based one of a kind unique voltage and recurrence scaling (DVFS) plan created in the YARN per-application ApplicationMaster to logically change the CPU repeat for cutting-edge endeavors given the slack time from past completed assignments. Preliminary appraisal exhibits that our proposed plot outmaneuvers the current MapReduce booking approaches similar to both asset use and vitality capability. [9] Enhancing the use of physical resources and decreasing energy utilization in a cloud server farm incorporates giving a majority of virtual machines in the cloud datacentre. Occasionally reallocating resources of the majority of virtual machines as indicated by a present resource request of the majority of virtual machines with a specific end goal to limit various dynamic physical servers required to deal with an outstanding task at hand of the physical servers. Augmenting a mean between movement time between virtual machine relocations under the nature of administration necessity dependent on a Markov chain model; and utilizing a multisize sliding window remaining burden estimation process for a non-stationary outstanding burden to amplify the mean between movement times.

D. Resource Utilization Based SLA-aware Frameworks

The objective of this paper [10] is to create advance vitality and SLA-mindful Virtual Machine (VM) situation methodology that coherently relegates VMs to Physical Machines (PMs) in cloud server farms. This arrangement structure co-advances centrality utilize and Service Level Agreement (SLA) infringement. The proposed game-plan handles utility capacities to portray the VM situation issue. A hereditary estimation looks through the conceivable VMs-to-PMs assignments with a view to finding an errand that broadens utility. Diversion results utilizing CloudSim demonstrate that the proposed utility-based logic decreased the customary vitality use by around 6 % and the general SLA infringement by more than 38 %, utilizing less VM relocations and PM shutdowns, emerged from an amazing heuristics-based method. The proposed computation fortify three levels of SLA controlled by the clients. Additionally, the estimations entwine the SLA gain cost for the practical finish of the association and SLA infringement cost for the unsuccessful end of the association. Authors [11] re-endorse the proposed estimations utilizing benchmark and delivered datasets. The outcomes obviously display that the proposed considers genuinely balance as a real part of makespan and gain cost of the associations in examination with different calculations.

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E. Comparative Analysis of Various SLA-aware Framework

The comparative analysis is presenting in Table I.

	In association					Technique
		Cost	QoS	RU	EG	ET	
SLA-Based Resource Scheduling Frameworks	[1]	y		y			punishment cost and enhance CSL
	[4]		y	y			Qos and SLA
	[5]	y	y				AaaS
	[2]	y		y			Federated CloudSim
	[10]			y			heuristics-based methodology
	[3]	y		y		y	DEIS frameworks
	[6]		y				MapReduce
	[7]		y				Fuzzy
	[8]			y	y		MapReduce applications with YARN
	[11]			y		y	Makespan
	Proposed	y	y	y	y	y	Antlion Optimization Algorithm
QoS= Quality of service, RU= Resource Utilization, ET= Execution Time, EG = Energy,							

The Fig. 1, demonstrate that, SLA-based frameworks generally focused on three objective functions. The major contribution is about resource utilization and then QoS and cost is align in the focus of interest to researcher.

F. Result of SLA-aware Framework Study

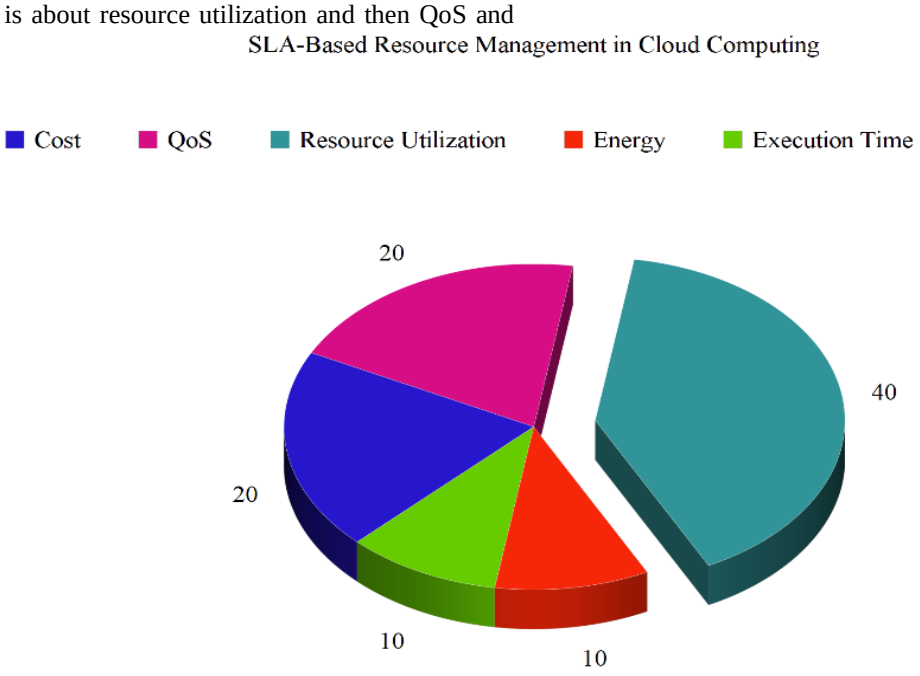

Fig. 1: Distribution of various objective functions utilized in SLA-Based resource management in cloud computing

III. PROBLEM DEFINITION

Based on above condition of quality overview, we found that the resource administration in cloud is a necessity for specialist co-op and cloud client also. The resource provisioning in cloud should be low in expense and SLA violation rate. In light of these two parameters, the accompanying perception carried out:

Problem: $F_1 = \max\{VM_u\}$ …(1)

$F_2 = \min\{s\}$ …….. (2)

$F_3 = \min\{C\}$ …….. (3)

Subject to Maximum VM utilization, Minimum SLA violation rate, and Minimum cost.

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IV. SLA BASED RESOURCE MANAGEMENT

The outstanding workloads at hand put together by cloud user is, ordered and assembled by its compose in various bunch by applying K-mean algorithm. In persistent, the need of every remaining task is ascertaining dependent on SLA violation rate, time and cost and mastermind in climbing request. To arrange the VM's in resource pool for appointing to various remaining tasks, we ascertain RAM, CPU, bandwidth usage, energy consumption and cost of each VM to figure best VM. Starting we have produces 20 VM's for 100 or more outstanding tasks. The architecture of proposed method is presenting in Fig. 2.

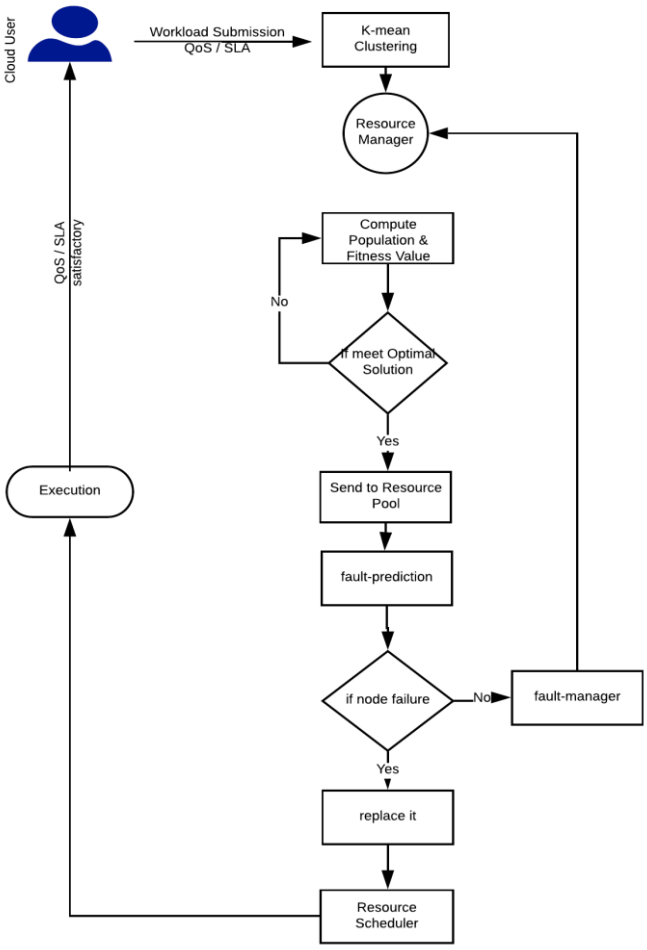

Fig. 2: Architecture of Proposed SLA-Based Resource Management Framework.

V.RESULTS AND ANALYSIS

The proposed framework simulated in cloudsim toolkit and computed SLA violation rate based on cost, execution time and workload submission.

A. SLA violation rate Vs Cost

The Fig. 3 is presenting the graph of SLA violation rate and cost. According to our experimental results, it recorded that SLA violation rate is decreasing, the cost is increasing. The SMART outcomes compared with CHOPPER and SOCCER and we observe that SMART performing better.

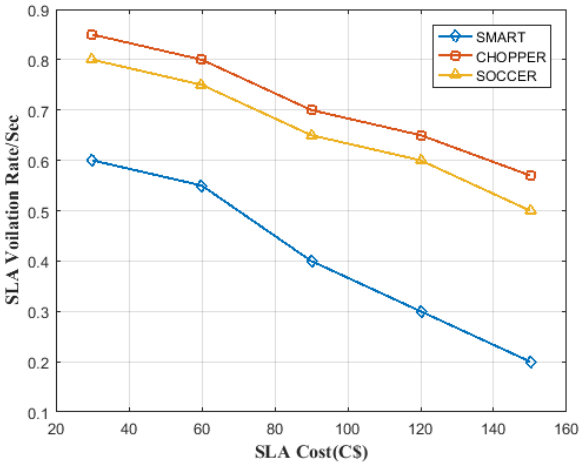

Fig. 3: SLA violation rate Vs Cost ($).

B. SLA violation rate Vs Resource Utilization

The Fig. 4 is presenting the graph of SLA violation rate and resource utilization. According to our experimental results, it recorded that while SLA violation rate decreasing, the resource utilization is increasing. The SMART outcomes compared with CHOPPER and SOCCER and we observe that SMART performing better.

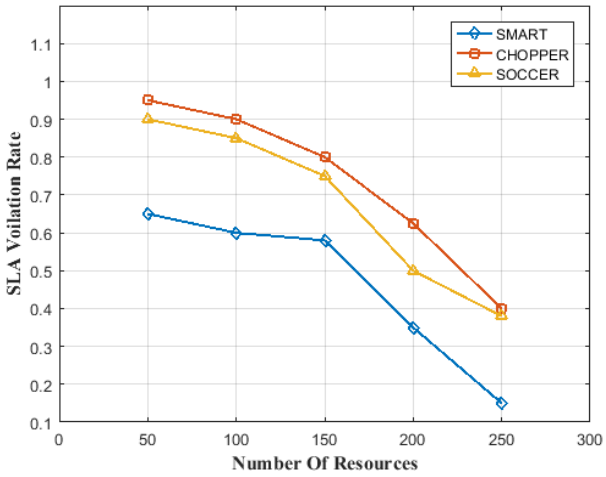

Fig. 4: SLA Violation rate Vs Resource

VI. CONCLUSION AND FUTURE WORK

We have reproduced SMART in cloudsim toolbox to minimize the SLA-violation rate, execution time and cost, which relies upon outstanding task accommodation by the end-client. SMART executed by utilizing Antlion-Optimization algorithm to locate the best resource from the resource pool to designate the resource according to request for by end-client. The best resource is get through its energy utilization rate, CPU, RAM, and Bandwidth usage, where we have set an edge an incentive for best resource as 100. As result, the execution time is minimize by 7-8% as contrasted and the current frameworks and cost of every resource is minimize by $5-10 as assessed with the present structures and SLA violation rate is additionally decreased by 14-15%.

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The SMART enhances the resource utilization by 20-21%. The execution of the SMART is assess with multi-target work to be specific time and cost and it saw that SMART performs better. The malicious workload need to identify through adopting self-protection technique, and it will be consider in our future contribution.

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