

International Journal of Future Innovative Science and Engineering Research (IJFISER)

Volume – 4, ISSUE – 1

ISSN (Online):2454- 1966



Research Manuscript Title

OPTIMIZATION TECHNIQUES FOR LOAD BALANCING IN CLOUD COMPUTING

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March – 2018

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ABSTRACT

Cloud computing is the way of computing, via the internet that shares computer resources instead of using software or storage on a local PC. It stores the data and resources in the open environment. So nowadays amounts of data storage increase quickly. Load Balancing is the main issues in Cloud which is required to distribute the dynamic workload across multiple nodes to ensure that no single node is overwhelmed. Major problems faced in the cloud are resource discovery, fault tolerance, load balancing and security. Distributed Load balancing is one of the main challenges, important technique, critical issue and play an important role which is required to distribute workload or task equally across the nodes or servers and also this thesis address and provides a detailed summary of the load balancing optimization techniques of evolutionary and swarm based algorithms which will help to overcome the optimization problems or resource utilization.

Keywords - *Cloud Computing; Load balancing; Optimization techniques; Evolutionary Algorithms; Swarm based algorithms.*

1. INTRODUCTION

Cloud computing has become one of the exponentially growing technologies. Cloud computing provide computing as utility to meet needs of the users. It encounters a fast advancement both in the academia and industry. Cloud computing adopts widely by Industries which is social networking websites like Facebook, Google doc etc. . Its popularity may because of the fact that it is a type of computing that Depends on sharing resources rather than having own servers or personal devices. With help of cloud computing resource of software and hardware could be shared reasonably to avoid shortcomings of knowledge redundancy occurred in early distributed network .The cloud computing deployment models are broadly divided into four groups: public, private, Hybrid, Community. These services are broadly classified into three types: (i) platform as a service (Paas) (ii) software as a service (Saas), and (iii) infrastructure as a service (Iaas) . The main objective behind load balancing is to distribute the local workload to entire cloud. Load balancing can be centralized or decentralized. The remaining paper is organized as follows Section II Introduction of load balancing, Section Literature Survey (Detailed Mechanism of Algorithm), and Section IV Different Techniques of load balancing, section V Conclusion

1.1 Load Balancing

It is the process of redistributing the total load of a distributed system into individual nodes to ensure that no node is overloaded and no nodes were under loaded or idle. So in a cloud environment load balancing ensures that no Vms are overloaded, where some Vms are under loaded or doing very little work . Load balancing tries to speed up the execution time of applications. It additionally guarantees the system stability. It is an optimization technique in which task scheduling is NP hard optimization problem. In this technique traffic is divided to servers, so data can be sent and received without delay. For the proper load distribution a load balancer needed which received tasks from different location and then distributed to the

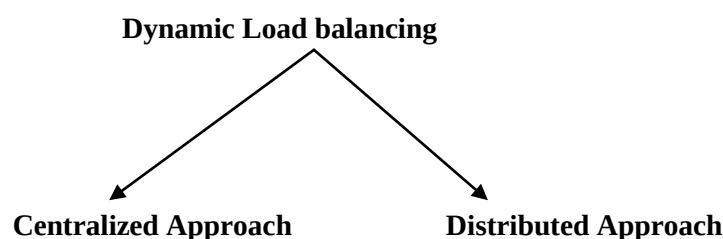
data center. If load balancing used in correct way then it achieve optimal resource utilization which will minimize the resource consumption .

Load balancing challenges:

- 1) **Overhead:** it should be minimum for good performance and it measured by the involved overhead at the time of implementation.
- 2) **Fault tolerance:** load balancing should be fault less for getting best performance.
- 4) **Migration time:** Time Taken By processor to transfer one process from one machine to another machine, it should be less.
- 5) **Response time:** it should be less and define as the time takes to the reaction of the process.
- 6) **Resource utilization:** full resource can be utilized by the machine and it should be high.
- 7) **Scalability:** ability to perform load balancing on Vm with more number of nodes.
- 8) **Performance:** it can be used to measure the performance of the process and it should be high.

There are basically two types of Load Balancing:

- **Static Load Balancing:** This approach is mainly defined in the design or implementation of system. Static Load Balancing algorithm divides the traffic equally between all users. It uses only information about the average behavior of the system. These are much simpler and ignore the current state or the load of the node in the system and there is no need to regularly monitor the nodes for performance statistics.
- **Dynamic Load Balancing:** Dynamic Load Balancing algorithms allows the partition of work between nodes at run-time; they use current or load information while making allotment decisions. The advantage, of such approach is that in case if one or more nodes in the network fail, it will not slow down the total Load Balancing process; instead it will improve the system performance to a little extent.



These are described as follows:

- **Centralized Approach:** Only a single node is responsible for managing and sharing the load within the whole system.
- **Distributed Approach:** In Distributed Approach, no single node is responsible for making resource provisioning or Task scheduling decisions. Multiple domains observe the network to make precise Load Balancing decisions.

2. LITERATURE SURVEY

In [1], Achar R, Thilagam Ps, Soans N, Vikyath Pv, Rao S, Vijeth Am. **“Load Balancing In Cloud Based On Live Migration Of Virtual Machines”**, proposed an Algorithm is compare and balance which allocates the resource dynamically based on need and distribute the load between the servers based on xen cloud technology (hypervisor) and credit system (default scheduler for xen) . There are three basic types of cloud deployment model available namely private cloud, public cloud, hybrid cloud and two variations namely Virtual Private Cloud and Community Cloud the Algorithm periodically checks the cup utilization and ram utilization when the resource needed it will provide via scaling if the resources is not available then migration will take place they set threshold value to 10(lower) to 70-95(upper).

In [2], Dam S, Mandal G, Dasgupta K, Dutta P. **“Genetic Algorithm And Gravitational Emulation Based Hybrid Load Balancing Strategy In Cloud Computing”** ,proposed an Algorithm is based on GA for solving load balancing problem among Vms through a combination of a GA and gel (gravitational emulation local search). GA has global nature towards the problem space where a gel searches. Authors find 2 fitness functions then apply mutation, crossover and selection. Genetic methods are a form of ideal search methods which replicate scientific evolution and natural selection in organism, which uses the series as generating the initial population, evaluation, selection, crossover, mutation, and regeneration. Genetic Algorithm is used for reducing the scheduling time. In addition, it a used as the technique of scheduling in which the jobs are assigned sources according schedules in context of scheduling, which tells about which source will be assigned to which task[6]. The idea of GA is that the modern generation of solution must be better compared to the previous one.GA represents a solution to the problem as a genome (chromosome).

In [3], Zhao Y, Huang W. **“Adaptive Distributed Load Balancing Algorithm Based On Live Migration Of Virtual Machines In Cloud”**, proposed an Algorithm compare and balance based on sampling to reach an equilibrium solution which decreases the migration time of virtual machines by shared storage and fulfils the zero-downtime relocation of virtual machines by transforming them as red hat cluster services. Live migration of virtual machines can be used to implement energy saving and load balancing in cloud data center. This paper focuses on live migration strategy of multiple virtual machine with different resource reservation methods.additionally,we analyse the efficiency of parallel migration strategy and workload-aware migration strategy. The merits such as downtime,total migration time,and workload performance overheads are measured.

In [4], Ashwin Ts, Domanal Sg, Guddeti Rm. **“A Novel Bio-Inspired Load Balancing Of Virtual Machines In Cloud Environment”**, propose an Algorithm based on PSO which will allocate Vm in an efficient manner and improve the response time. They use cloudsim technology for the implementation. PSO calculates and updates the fitness value of the candidate solutions in a search space to find the optimal solution. Based on behavior of cats, author in has defined two sub-models of cat swarm optimization, namely, trace mode and seek mode. To solve unimodal and multi-modal problems, Runner-Root Algorithm is used, inspired from runners and roots of plants. Intelligent Water Drops obtains optimized result by mimicking the behavior of natural water drops. It manages the load at the server and intelligently assigns it to all the available Vms by considering its status.

In [5], Zhang Z, Zhang X. **“A Load Balancing Mechanism Based On Ant Colony And Complex Network Theory In Open Cloud Computing Federation”** ,proposed an Algorithm based on ACO combination of ant colony and complex network theory for occf (open cloud computing federation) which has many cloud provider it improves many aspects of the related ant colony Algorithm which

proposed to realize load balancing in distributed system ,to get max performance. Ant Colony Optimization (ACO) is really a computational process that's influenced from the method by which of ant colony seeking the smallest trip from the meals mention of the home without aesthetic aid. Within their exploring, bugs deposit a volume of pheromone while strolling to produce a stage and communication with other ants. Those who couldn't scent the pheromone, they hold travelling at arbitrary route. The pheromones of particular journey are increasing when more bugs are well tracking about this to acquire the shortest one. ACO methods are useful for solving discrete optimization problems that need to find paths to goal

In [6], Zhu K, Song H, Liu L, Gao J, Cheng G. **“Hybrid Genetic Algorithm For Cloud Computing Applications”**,proposed an Algorithm based on GA for getting good performance, which is multi-agent genetic Algorithm (maGA) is a hybrid Algorithm combining GA and multi-agent techniques. Genetic algorithm is a unique algorithm for some of the reasons like the optimum solution is built not only by a single entity but various entities, which traverse the length and breadth of the cloud network and then these individually build upon the solution and thus it is used for load balancing. This report present suggestions the implementation of load balancing in cloud processing is currently complex and it is difficult to achieve. Multi-agent genetic algorithm (MAGA) is a combination algorithm of GA, whose effectiveness is much superior compared to that of the normal GA. That report reveals the key advantage of MAGA over conventional GA, and then exploits multi-agent genetic calculations to correct any danger of strain handling issue in cloud processing, by preparing a whole lot handling type on the building blocks of virtualization guide management. Ultimately, by assessing MAGA with Small technique, the test benefits show that MAGA has the capability to obtain better effectiveness of load balancing. The proposed methodology is to ensure that all the processors in the system or every node in the network does approximately the equal amount of work at any instant of time. And also improves many aspects of the related algorithm which is implemented to realize load balancing in distributed system.

In [7], Nishant K, Sharma P, Krishna V, Gupta C, Singh Kp, Rastogi R. **“Load Balancing Of Nodes In Cloud Using Ant Colony Optimization”**, proposed an Algorithm based on ACO for load distribution of workloads among nodes of a cloud. . At monitoring stage, Algorithm takes both the old and new system condition to avoid unnecessary migrations. This algorithm adopts two different traversing strategies for ants to find the near-optimal mapping relationship between virtual machines (Vms) and physical machines (pms). The approach is ants continuously update a one single result set rather instead of updating their own result set so the solution set is gradually built on and continuously improved. The ants are divided into two categories: forward ant and backward ant, which is the same mechanism described in [34] but with distinct definition. The forward ant is responsible to find the candidate nodes for load balancing in cloud computing platform and it starts the searching activity from its generated node. The candidate nodes include overload nodes and under load nodes. The backward ant is in charge of updating information pheromones for the path as that of its corresponding forward ant, but in the opposite direction. The backward ant is generated at each time when the forward ant identifies a candidate node.

In [8], Yao J, He Jh. **“Load Balancing Strategy Of Cloud Computing Based On Artificial Bee Algorithm”**, proposed an Algorithm based on bee colony optimization through imitation of behavior of honey bees, it optimizes the amount of nectar (throughput) to reach the maximum throughput. Artificial Bee Colony (ABC) algorithm was proposed by Karaboga. This method is inspired by the foraging behavior of honey bees. In this model, three kinds of honey bees are used to search food sources, which include scout bees search for food source randomly, employed bees search around the food source and share food information with the onlooker bees, and then the onlooker bees compute the fitness and select the best food source. After scout bees find the food source and return to the hive, they compare the quality of food source and go to the dance floor to perform a dance known as “waggle dance”. The waggle dance is the communication of bees to share the information about road of the food source, distance from the hive, and

the nectar amount of the food source. While sharing information, bees evaluate the nectar quality and energy waste and after sharing the information on the dance floor, onlooker bees select the best food source and then scout bees will return to the food source to bring nectar back to the hive.

In [9], Aslanzadeh S, Chaczko Z. **“Load Balancing Optimization In Cloud Computing: Applying Endocrine-Particle Swarm Optimization”**, proposed an Algorithm is based on PSO and also using endocrine Algorithm which is inspired from behaviour of human’s hormone system. LB achieve by applying self-organizing method between overloaded Vms. This technique is structured and depends based on communications between Vms. It helps the overloaded Vms to transfer extra tasks to another under loaded Vm by applying the enhanced feed backing approach using PSO. Particle Swarm Optimization is a global optimization algorithm, based on the swarm intelligence. This algorithm can deal the problems which is the best solution is represented as a point or surface in an dimensional space. Initial Velocity can be calculated for the particular particle will move their path known. As well as the communication channel can send to another particle which is moving on the communication

In [10], Sun W, Ji Z, Sun J, Zhang N, Hu Y. Saaco: **“A Self Adaptive Ant Colony Optimization In Cloud Computing”**, proposed an Algorithm is based on ACO that is self-adaptive ant colony optimization tasks scheduling Algorithm. PSO algo is used to make ACO algo self-adaptive and they also improve the calculation and update of the pheromone. Author shows that, the Ant Colony Optimization technique which is a Load Balancing technique is based on Swarm Intelligence. Ants while searching for food initially start searching randomly by laying a chemical substance called *Pheromone* and upon finding the path to the food, they return to colony via shortest path based on the pheromone intensity. The remaining ants follow the path based on the intensity of the pheromone i.e. ants follow the shorter one as the density of trail pheromone is more. However, as time passes the pheromone intensity starts evaporating, the evaporation of pheromone provides an advantage of finding optimal solution. In Cloud Analyst tool, ant is considered as cloudlet and food as virtual machine. The ants in our proposed algorithm will constantly initiate from the Head node. The motive of this paper is to produce an effective Load Balancing algorithm using Ant Colony optimization technique to enhance or decrease different performance parameters like CPU load, Memory capacity, Delay or network load for the clouds of different sizes. They have also explained the working of a load balancer that how it works and what the various phases of the load balancer. In this paper, a heuristic algorithm is proposed which is dependent on Ant Colony Optimization.

3. PROBLEM STATEMENT

In specific, Cloud services are vulnerable to DDoS attacks. It’s very difficult to identify the legitimate traffic from the attack traffic. Detecting and filtering the attack is a challenging task in an environment like cloud where everything is virtualized. There is no one technique available, which can completely eliminate the DDOS attacks. Denial-of-service (DoS) attack is an attempt to make a computer resource (e.g. the network bandwidth, CPU time, etc.) unavailable to its intended users. To overload the necessary network and CPU resources, attackers tend to use a large number of machines to launch the Distributed DoS (DDoS) attacks .The DDoS attack in a non-cloud environment may not necessarily disturb the service, but it may contribute to economic loss. As the cloud environment is highly scalable, the service will consume more resources during attack period to maintain the SLA, which in turn contributes to the revenue loss.

4. PROPOSED SYSTEM:

In the Cloud Computing, one of the objectives is to allocate the tasks to appropriate virtual machines, for execution. Before allocating the tasks to the virtual machines, resource requirement for task execution and resource availability of the virtual machines is considered, to select the best virtual machine for task execution. When any virtual machine is under-loaded or over-loaded, tasks need to be migrated from one virtual machine to another. To allocate the tasks to appropriate virtual machine, Bat algorithm is used, along with the concept of Tabu Search. The use of Tabu Search will provide the ability to the bats to memorize the visited solutions and avoid visiting it again and also avoid the bat to visit the neighbors of current best solution. The neighbors of visited solution are placed in “Non-Allowed” set. The solutions which are placed in “Non-Allowed” set will be used for migration of jobs during over-load and under-load situations of virtual machines. In this proposed algorithm, tasks will be considered as artificial bats and virtual machines will be treated as prey. Distributed Denial of Service (DDoS) attacks in cloud computing environments are growing due to the essential characteristics of cloud computing. software-based traffic analysis, centralized control, global view of the network, dynamic updating of forwarding rules, make it easier to detect and react to DDoS attacks. Distributed denial-of-service (DDoS) attacks remain a major security problem, the mitigation of which is very hard especially when it comes to highly distributed botnet-based attacks. The proposed algorithm offers better exploration and diversity of search space, by avoiding visiting the same solution again. In this they collect network traffic packets and flow information are collected in real-time and Pre-process network traffic with and then predict DDoS. The IPSs form virtual protection rings around the hosts to defend and collaborate by exchanging selected traffic information. The evaluation of FireCol using extensive simulations and a real dataset is presented, showing FireCol effectiveness and low overhead, as well as its support for incremental deployment in real networks. Conventional detection and forensics methodology can then be used to gather information on the intruder who will be unaware that they are not using “real” server.

In the proposed thesis collect network traffic packets and flow information in real-time and Pre-process network traffic with and then predict DDoS.

- Firecol which it has “Invite the Attacks” with confidentially.
- Use of Firecol provides effective solution to increase the security and reliability of the network.
- The process of forwarding requests to the Balancer detects traffic as an attack on the server; it is then directed to an alternative server – a type of FireCol.
- Conventional detection and forensics methodology can then be used to gather information on the intruder who will be unaware that they are not using “real” server.

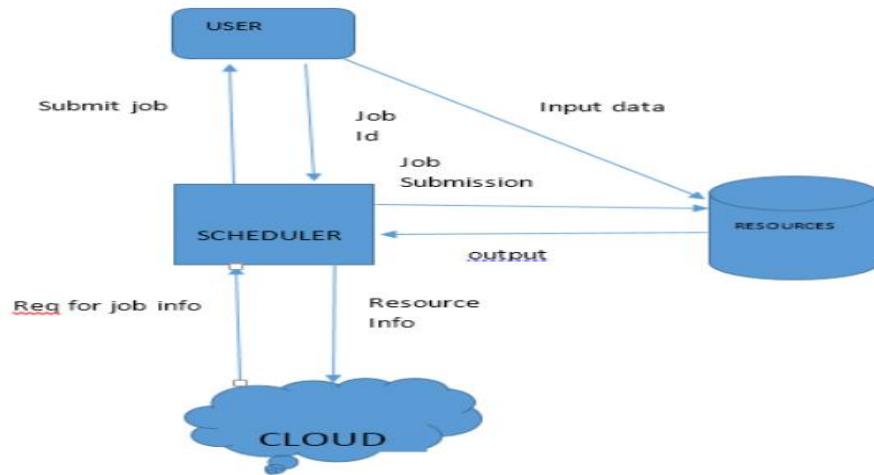
- **SYSTEM METHODOLOGY**

- **METHODOLOGY:**

- **IDS or FireCol**

- FireCol is composed of intrusion prevention systems (IPSs) located at the Internet service providers (ISPs) level. The IPSs form virtual protection rings around the hosts to defend and collaborate by exchanging selected traffic information. The evaluation of FireCol using extensive

simulations and a real dataset is presented, showing FireCol effectiveness and low overhead, as well as its support for incremental deployment in real networks.



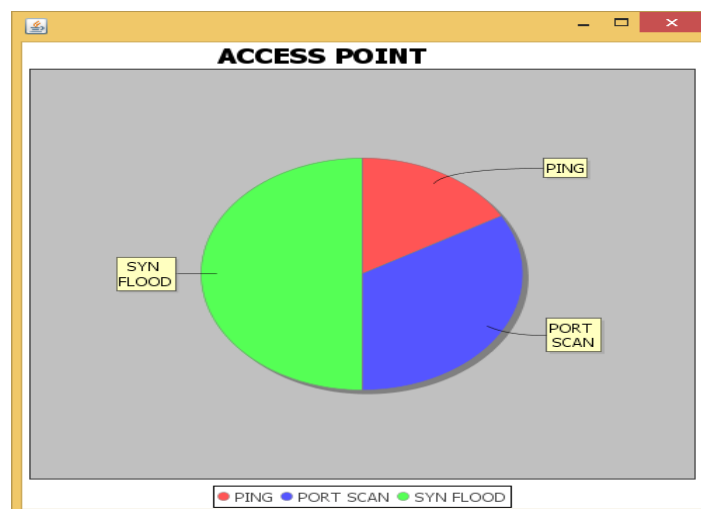
OPTIMIZATION TECHNIQUE

PSO algorithm

In this technique traffic is divided to servers, so data can be sent and received without delay. For the proper load distribution a load balancer needed which received tasks from different location and then distributed to the data center. If load balancing used in correct way then it achieve optimal resource utilization which will minimize the resource consumption.

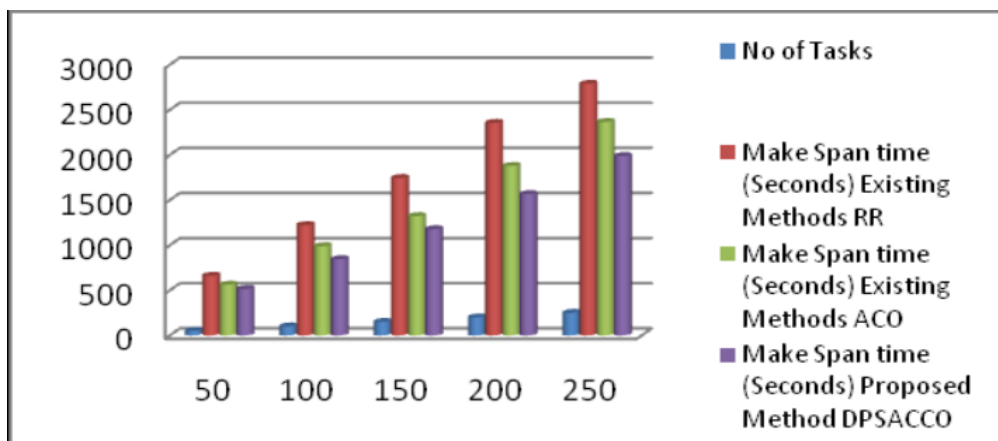
5. OUTPUT

The load balancing with DDOS attacks provides reliable communication between server and clients. It also enhances active communication which remains unaffected even in the presence of DDOS attacks. Sometimes it is difficult to intrude into communications and the information's are highly secured. Due to less probability of hacking, Effective and efficient response processing for incoming requests. Proposed concept includes Load balancing in an effective manner. The Firecol mechanism provides high confidentiality by inviting the attacks.

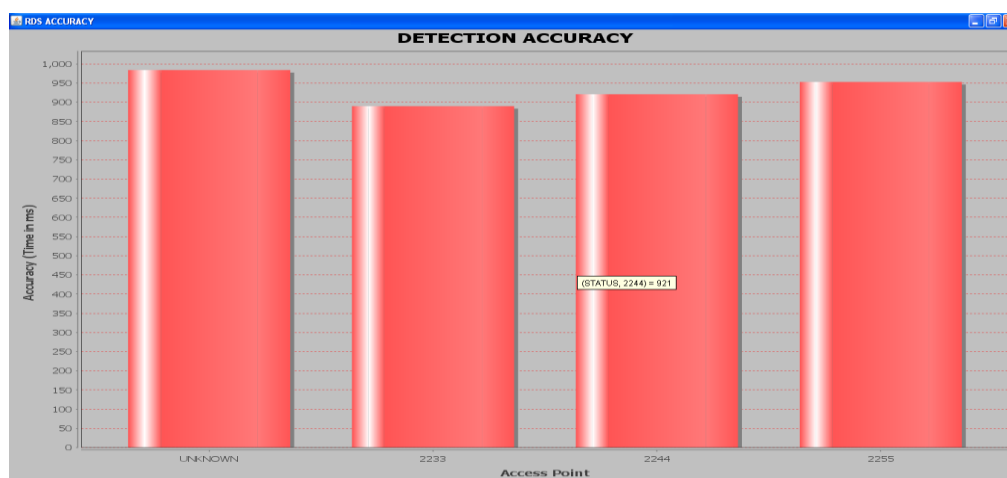


6. PERFORMANCE EVALUATION

The experiment is implemented with 20 Datacenters with 100 VMs and 50-1000 tasks under the simulation platform of cloud sim. The length of the task is from 1000 MI (Million Instructions) to 20000 MI. The implementation of existing ACO algorithm, Round robin algorithm and proposed DPSAACO algorithm and investigated their relative strengths and weaknesses by experimentation. The parameters (α , β , P , T_{max} , k shows number of ants). The default value of the parameters was $\alpha=1$, $\beta=1$, $\rho=0.5$, $Q=100$, $T_{max}=150$ and $k=8$. MakeSpan Time can be defined as the overall task completion time.



6.1 Makespan Time Comparison



6.2 Accuracy Detection

7. CONCLUSION AND FUTURE ENHANCEMENT

Cloud computing is effectively handle the future computing requirements, it's necessary to optimally handle issues arising during cloud computing environment. Load balancing is important critical issue which affects the utilization of resources and performance of the system run on cloud. In this paper, different techniques are studied and discussed for load balancing. This work provides the best optimal solution thereby it simultaneously decreases the load in this developed system. This is done by improving the existing AB algorithm. It drastically reduces the load of the other systems thereby providing a better flow of work for the systems. This surveyed some evolutionary and swarm based optimization techniques with their application and suitability to specific area and environment.

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