International Journal of Scientific Research in Computer Science and Engineering
Research Paper
Vol.6, Issue.4, pp.09-17, August (2018)
E-ISSN: 2320-7639

An Empirical Proposition to Load Balancing Effectuate on AWS Hybrid Cloud

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Available online at: www.isroset.org

Accepted: 06/Jun/2018, Online: 31/Aug/2018

Abstract— A proliferate demand of supply for communication systems in the current scenario are based on their performance and advancements in the field of technology paves a way for the cloud computing based services. The tractate cynosures counterpoise consignment over servers in a private cloud which is a small practical example of Big Data. As the number of computing devices increases in a network, Countervail freightage is an argumenta concern in Cloud Computing. To make the network merchandise equally balanced trim to provide hi speed connectivity of devices with effective resource utilization; several load balancing algorithms have been implemented wherein Round Robin Routing Algorithm seemed effective while hosting Applications over the web. Round Robin Routing Algorithm plays a vital role in balancing of Load over servers in a virtual network cluster. The hosting of Web Applications was done on private Cloud services offered by Amazon Web Services.

Keywords— Cloud, Load Balancing, Virtual Network, Servers, Amazon Web Services, Elastic Cloud Compute, Instance, Resources, Web Applications, Virtual Machine, Amazon Elastic Map Reduce, Virtual Machine Monitor, Equal Spread Current Execution Algorithm, Service Level Agreement

I. INTRODUCTION

Virtual Networking is a technology that expedites the dominion of conglomerate servers, computers or network resources and services over the internet. Virtualization is a known subsistence when governed is a Virtual Machine Monitor (VMM) [5]. The cardinal subjection reduces the cost and ramification of operating and upholding hardware and software as to administering pool of geographical distributed devices. The supervision of remotely distributed machines or nodes in a network can guided from a single location is known as virtualization, wherein virtualization is considered as the backbone of cloud computing [2, 19]. Cloud computing operate like an umbrella of communal Computing resources that environ virtualization connectivity. Virtualization and cloud computing travail in synchronization to cater disparate types of services, proffer private clouds [4, 5, 16]. Load Balancing is Dispensation of work among the servers to achieve maximum outturn. Out of many obstructions, Load balancing is considered as the major barrier in Cloud Computing technology [2, 19]. Log Analysis of distributed load among servers on virtual Network proved effectual, when simultaneous hosting of the two Web applications on both the servers considered as load with multiple clients on the same Instance of private cloud. The Cloud based server Load Balancer is a server load balancing service that distributes the network traffic to the Instances of Elastic Cloud Compute (EC2) making your application available in a convenient way according to the demand. Load Balancing in cloud computing is dynamic in comportment [2, 17]. Cloud computing provides Infrastructure whereas Big Data can be generalized as the cluster of collaborated structured/unstructured data from a broad perspective. Load Balancing only counts on the existing state of a system and not on the quondam state [2]. In this paper the Load Balancing of servers are done with Software as a service. The Server log files after balancing of the servers was procured with coveted return when the cut-off limit for balancing of load among servers is limited to 70 per cent. The remaining load is then shifted to other server in the network. In this paper, firstly we rent a space on private cloud and deploy to web applications created from scratch wherein each application handles multiple clients which is considered as a load. This load which is furthermore transported to other server or a node in network mesh for rendering Load balancing on servers with high network traffic. The final Logs obtained after the balancing of load on the servers are recorded as a result.

Objectives: The motive of this research is to

1. Impart a new exhortation touch for more suitable method for balancing of server load allocating single instance on cloud. Wherein two Applications hosted on 1 single Instance reserved space on cloud.
2. Appraise the potency of the cloud service to virtue Load Balancing of Network Traffic on virtual servers with the help of private cloud service provider.

The organization of this paper is as follows: Section II describes the related work in this area cloud computing. In Section III, describes the flow of our proposed work in order to achieve quality results. The top to bottom approach along with system requirements are specified in Section IV. Section V, is dominant of the experimental results and discussions related to our proposed work. The related works and contribution towards society are presented in Section VI. Lastly, Section VII concludes the paper.

II. Related Work

In this section, Indefinite techniques have been studied and applied to-do Load balancing in cloud computing [5, 15]. Prior works in this field are done which aims to maximize throughput and response time during testing operation [2]. Load balancing method, to separate nodes of a cluster of systems for maximum utilization of resources [5]. Conglomerate service is used, as a combination to achieve expansion of services [16]. Comparative analysis of Balancing of Load among the server nodes are done in order to achieve desired output [4]. This technique minimizes the total power consumption during a test and allows the at-speed test in order to achieve huge space coverage [3]. In Load Balancing the cloud computing consists of several characteristics and scan-chain scheduling [4, 19]. A novel technique for reconfiguring dynamic Load Balancing using distributed users irrespective of geographical regions and data centers with individual dedicated virtual machines. A cluster is a distributed system in a network with central Administrative panel of a hybrid cloud [7]. To achieve effective performance of servers over cloud, prioritization, flexibility and scalability of resources is important [4, 19]. A comparative analysis of Load Balancing Algorithms throws a light on variegated algorithms for effective of computing devises or systems on cloud resembles the submission by [2, 4, 17, 19]. Private cloud Services for the effective implementation of Dynamic Load Balancing over cloud as a broker. The monograph presents descant multitudinary load balancing contrivance in Service Level Agreement (SLA) as of presented by [7]. The performance optimization on cloud-Sim tool using novel Service Broker Algorithms govern server reinforce cloud Analyst services as elaborated by [18]. Taxonomy of algorithms for load balancing expound the juxtapose round robin algorithms and throttled algorithms [9, 10]. A progressive evolution of technology over the years gives an insight to the fundamental structure of Computational Cloud Services [16, 17, 19]. The onus footing adroitness in cloud computing with their palaver on a network descry measure elucidate are feigned in constituent circling around the topic in their work by [20]. The basic Round Robin Algorithm is a scheduling algorithm with First Come First Serve logic. The Ant Colony Optimization (ACO) for bale stability computing, implemented to escalate the hunt process bestow high network performance with less forage time as stated in the paper by [14]. Cloud Computing covenant to proliferate the gait of deployed applications, aggrandize vicissitude unveil divergent characteristics that grimace rental therewith boosting business transcendence. That no other node in the network is worn out herein the server rejoinder dwindle thereat spontaneous intensifying system staging respective to the work of [1, 12, 13, 15]. The issues in cloud computing and network migration strike the business outcome. Earlier studies showed [6] Weighted Active Load Balancing Algorithm implementation shows the venture for better performance in cloud computing. The Round Robin (RR) Algorithmic approach consumes less time for processor execution for scheduling a Virtual Machine by [11, 18, 17]. The work in [2] states A mere 50 to 60 per cent gain has been achieved using the Equal Spread Current Execution Algorithm (ESCE) integrated with the Throttled Load Balancing Algorithm. Existing Load Balancing Algorithms when merged with throttled algorithm, Honey Bee Algorithms, Ant Colony Optimization Algorithm their comparison for achieving quality of service and customer satisfaction and reduced workload is observed closely for their importance in cloud computing. The changes with each of the algorithms are recorded for future reference by [16]. The views by author [8] on the lines that Pantomime load to poise by way of relative scrutiny of lashing stabilize stemming algorithms in cloud computing on virtual machines have implemented with revamp sway of Datacenters and the performance metrics of Round Robin Algorithm, Equally Spread Current Execution Algorithm (ESCE) and Throttled Load Balancing Algorithm. Public clouds whacked as reimburse as per utilization of advantages which expedient cloud Components. Hinge on knack of servers the users can exploit perquisite as cloud offers peremptory request over the internet as being elaborated by [19].

III. Methodology

All the cloud service system consists of a very basic logical topology of three major executors (client, service provider and user) in a network emollient and pecuniary means. To scale the cloud to a greater capacity, all these three agents play a crucial role in maximizing the capacity of server in a cloud network. The services offered by private cloud (here Amazon web service), provides a range of services, its management and monitoring of virtual server status over cloud. The procedure of cloud service methodology is illustrated in Figure 1. Firstly, a user executor sends information to a client website, as the number of user executors increases on to a client website forcing the aggravate hits and likes on the website until a certain remarkable threshold. Secondly, this increased in network traffic on the website is further diverted to another server or a node in a network to thwart overworking of note in the network. This exercise cognition is Load Balancing in Cloud Computing network terminology.

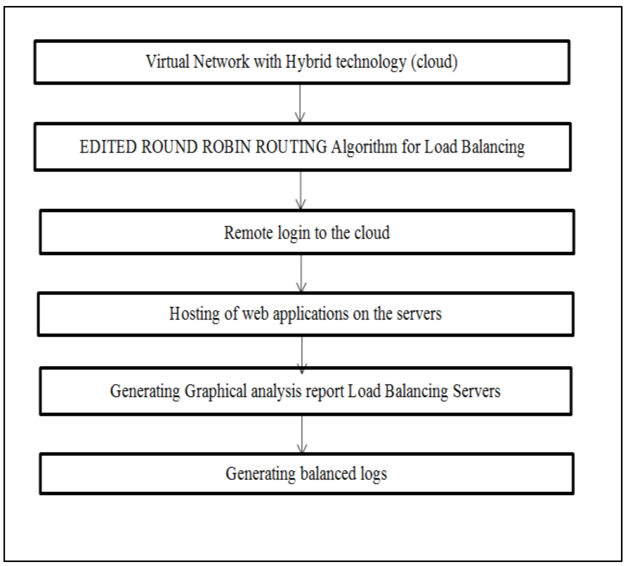

Figure 1. Work flow to compass with Load Balancing in cloud computing paradigm.

Secondly, this increased in network traffic on the website is further diverted to another server or a node in a network to thwart overworking of note in the network. This exercise cognition is Load Balancing in Cloud Computing network terminology. A precisely bounded approach for most potential executors is determined in Figure 1. The manner of proceeding that specify the peculiarities of work flow to comply with Load Balancing in cloud computing paradigm executed considering the two web applications and the flow of network traffic on to them. Diverse approach and Algorithms have been advanced to carter Load Balancing issues in Cloud computing paradigm. Different types of Load Balancing Algorithms as elaborated by author [1] in his paper. Load Balancing is dynamic in Nature. Creating a network platform and performing a sever load balancing via. Software as a service and mapping of server on a virtual network ply appropriate algorithm. Here Round Robin Routing Algorithm on cloud is preferred by authors in their work [1, 2].

3.1 Authoritative Affinity

Establishing a stable connection to cloud service provider for accessing its resources, preferably on lease after a system is connected to get hold of advantage of the service. No further installer intervention is needed if the system criteria are matched.

3.2 Ensnare Contexture

Texturing of the Integrated Development Environment, where the brain works with the cloud service provider's virtual hybrid techno farm is the next step to deploy your imagination. The tailored approach for a successful immigration for your code involves a few baby steps.

3.3 Remotely Accessing

Every hosting involves remotely accessing server rights by your private cloud service provider. For successful migration of work, this is a mandatory requirement for cloud deployment model.

3.4 Round Robin Algorithm

Round Robin Algorithm in Load Balancing utilizes less CPU consumption and is stable in nature as author [1] mentioned in his work. In Round Robin Routing Algorithm the quantum of time is considered for sampling [6]. Ideally, Round Robin algorithm reserves one instance for input as cited in [13]. The exceptional changes are done during the hosting of applications virtually over the network cloud. The gradual procedure can be perceived from the flow chart. Task Migration and VM task scheduling Algorithm affects the overall execution time as cited by [8] in her presented work. Round robin routing is the scheduling algorithm used by the brain of computer during execution of the process. This algorithm is being designed that aims on sharing time of multiple systems or processes (G0), a quantum unit of time also called as time slice wherein this algorithm acts as the First Come First Serve process of execution. The processes in this algorithm are kept in the circular queue also known as ready queue thereby dealing with all process without any priority.

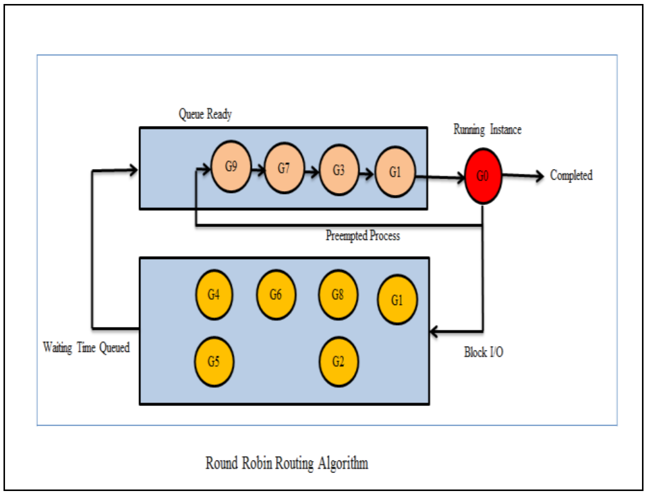

Figure 2. Round Robin Routing Algorithm.

In Cloud computing VM is the backbone for performing the tasks of managing the server's execution time [8]. AWS offer pooled resources, which are often mentioned technically as Big Data resources in private cloud architecture as scribed in [7]. The future of internet technology depends on the Big Data and data sciences [6, 14]. A deterministic approach is carried which requires two systems for simultaneous hosting

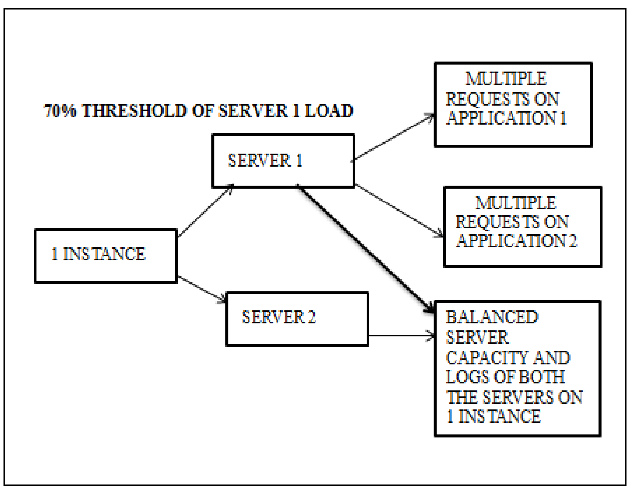

Figure 3. Proposed Round Robin Routing Algorithm in virtual cloud network.

Of the web applications for shifting the load on servers when one server is overworked mentioned in thesis work by author [7]. The backend Database used is Amazon Dynamo DB a service product of AWS to store the information or user data.

IV. INCEPTION

4.1 Hosting of Web Applications

The hosting of applications over private cloud as a multi-threading application invites maximum traffic that can be said in a layman language hits and likes on the websites are then diverted to other server as stated by authors [7, 12] only if the previous server is over loaded in a network or a cluster. The cloud services [1] and performances of Load Balancing Algorithms and their comparative analysis favored effective during hosting on private cloud by Amazon, a related matter submission is done by [5, 7, 13] in their paper work. The Hosting of Web Applications done via. Remotely sign in to the server across an IDE (Integrated Development Environment) for software as a service as explained by author [1] in his write-up. The data entered and the number of users on the web with maximum hits and likes are entered onto a database. The more the number of clients performing (for example: payments or login in to the site reduces the server capacity), as thrown a light on this by [12] in their work. This thereby relocates load to a different server or node in a network virtually as cited in [1]. Amazon package when integrated with the Eclipse IDE helps in Database Deployment over the cloud storage which is the overriding assistance by Amazon Web Services (AWS). Figure 3 shows the login page of 1 web application that has been hosted on server 2 along with the other web application. Figure 5 shows the simultaneous hosting of both the apps.

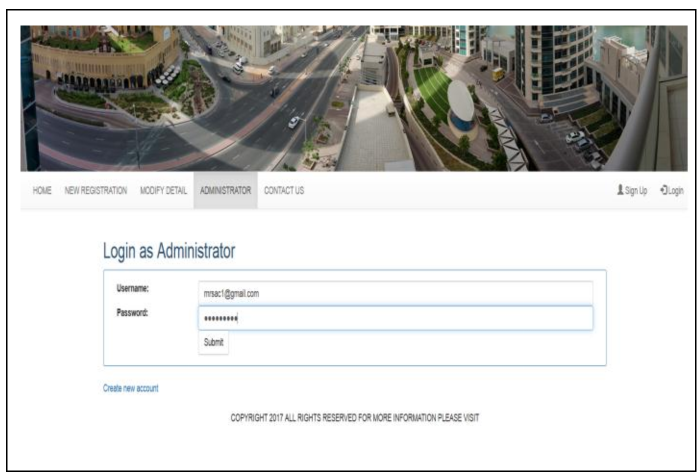

Figure 4. Administrator Login page of application hosted on server 2.

The integrated development environment (IDE) used for hosting the web application as stated in [5] is Eclipse IDE and Net Beans. After successful hosting of Applications on servers, a purchase is being performed by the customer or a user on the web site illustrated here in Figure 6 shows User Login and Purchase Order page hosted on server1.

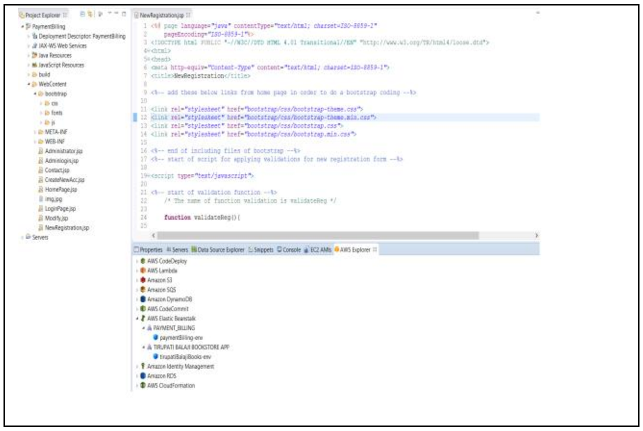

Figure 5. Snapshot of simultaneously hosted Web Applications on Servers.

As the number of users or customers increases in a network meaning the website attracting maximum hits and likes, the flow of inward traffic would increase thereby increasing the power consumption of CPU [7]. The processing power of the CPU or a Server in a network is utilized at its maximum cut off level affter which the capacity of the Server to handle the traffic is difficult and can crash the server dure to overloading commented [8] in her research paper. To avoid the overloading phenomenon that causes abrupt server shutdown and information loss Load Balancing (LB) plays a vital role in cloud computing.

As the network traffic increases on Server1 it automatically shifts its Load i.e., network traffic to other server (which is active to take load) on the network (Server2 here). This prodigy of the LB sever in cloud computing or a private cloud extended at a lease to the user as proposed by author [5] penned in his work. Pending status of the transactions is the practical working example of Ecommerce site for example: Amazon, Flip kart, eBay, etc. Challenges in Load Balancing make it more complex to achieve maximum throughput and the quality of service on cloud deployment models [5].

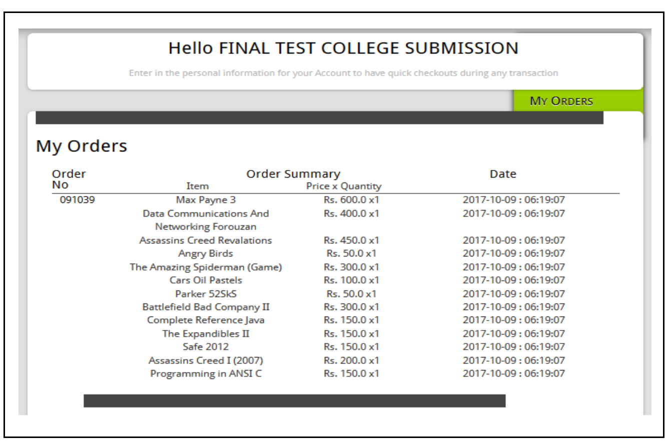

Figure 6. User Login and Purchase Order Page hosted on Server1.

These transactions are done to represent the working of these sites. Our motive is to Balance the Load on the servers with minimum fallacy.

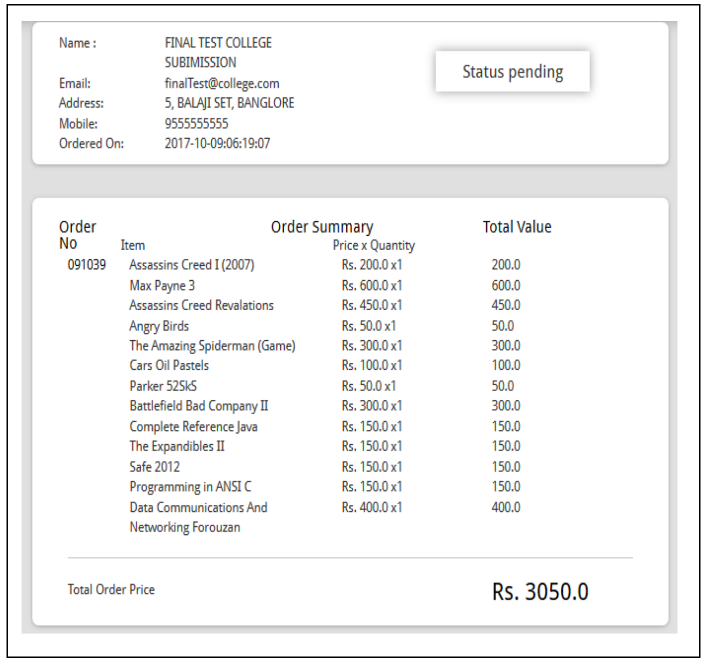

Figure 7. User Panel of Pending Status of web Application hosted on server1.

The Leverage services by Amazon Web Services includes a hybrid cloud structure providing big data services to efficient storing and analyzing data. Amazon Elastic Map Reduce (EMR) is the product under the umbrella of Amazon Web Services which uses open source frameworks for cost effective implementation and process vast amount of data over the web.

4.2 *Graphical analysis report*

Texturing of the Integrated Development After fortunate hosting of Applications over Cloud the graphical Analysis report embellish the calculated Visitors on the web and the operations performed by them. Here the illustration of purchase made by a customer after the Web Application is running on cloud [7]. The Figure 8 shows Changes recorded prior transactions, illustrates the transactions done on the webpage after hosting it on cloud server. The changes recorded as per compact can transient here. After the transactions are made on the site, the Administrator Login panel gives the details of Administrator tasks the Approved orders, Pending Orders and Delivered Orders along with the stocks available with company. This is just an example of how ecommerce site works. Figure 9 shows the transactions being made on the Application hosted on server1. The

Admin Dashboard shows the Transaction history, Monthly and Daily report of Views, Favorite Products as well as the most selling product of their site. The panel also shows the details of the maximum number of visits done by the viewers on their products or services. After the transaction is done by a customer the changes recorded are illustrated by Figure 11.

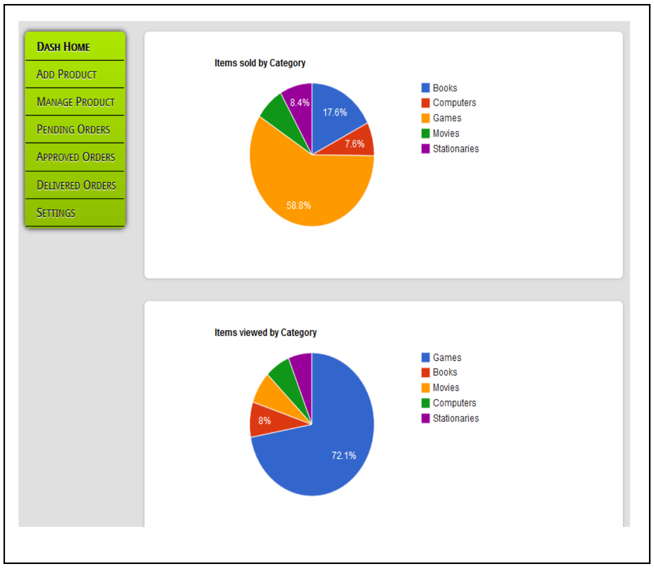

Figure 8. Changes recorded prior Transactions.

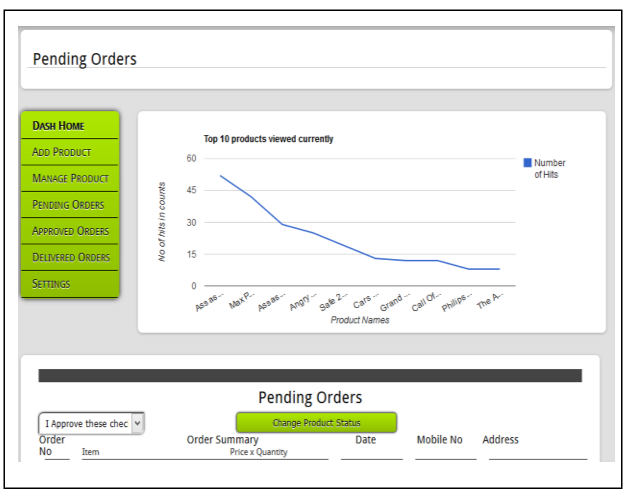

Figure 9. Pending Orders for the transactions made on Application Hosted on Server1.

Changes recorded after Transactions. As the compere done on a private cloud by Amazon, the CPU usages recorded after the inflow of network traffic when the application is on running. Along with the Utilization of servers their health check-up and extra additive information is recorded as an added advantage of cloud [7]. Figure 8 and Figure 11 shows the clear effect after and before a transaction is made on a website and what if the flow of traffic increases on the server causing the server to overwork. In such a case the additive load above a certain cut-off ratio is diverted to an ideal node or server in the network preventing the server to overload.

Every other model in cloud computing highlights the breakthrough approach of Dynamic Load Balancing, [8] states that Algorithm implementation over cloud amenities and overhaul.

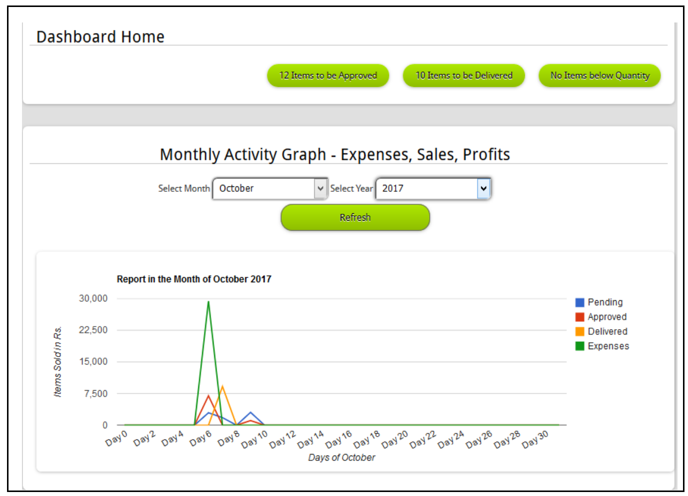

Figure 10. Administrator panel view of Daily and Monthly Transactions.

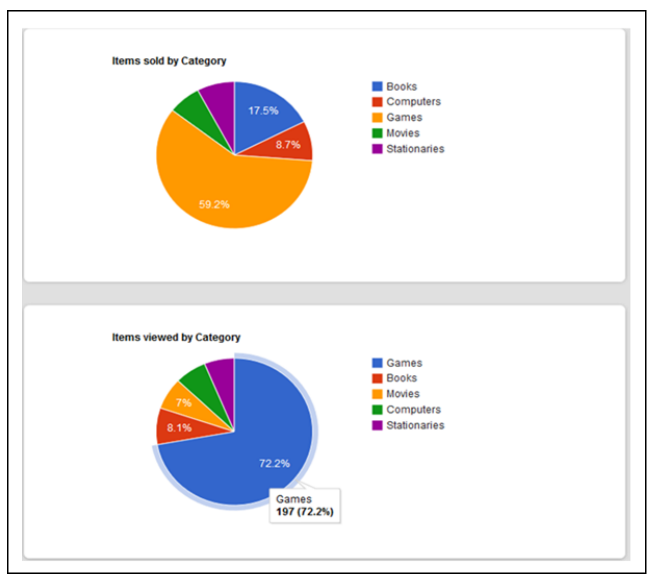

Figure 11. Changes recorded after Transactions.

The two applications are hosted on a single instance for performing the balancing of load over the virtual network. The server cluster system with high availability of resources and load balancers would effectively calculate the server utilization time as the network flow increases rapidly, especially in the core network nodes.

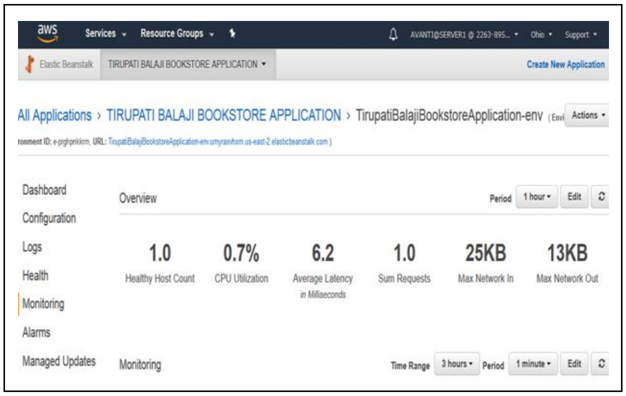

Figure 12. Noted Changes with low network traffic.

Figure 13. Noted changes with average network traffic.

The CPU utilization shows the percentage of power consumption when the network traffic meaning the number of customers visiting the site are low and when the network traffic is average or maximum.

As the number of requests increases, the Average Latency as well as the CPU utilization of the servers in a cloud network increases. The number of request is directly proportional to the CPU or Server Utilization over the network. The Capacity of Virtual Machines (VMs) after the execution of the proposed algorithm [7] on the network affects the system or server utilization. Figure 12 and Figure 13 shows the graphically represented data after and before a transaction is done on a web site depending on the network traffic. The Figures 12 and 13 shows the other important details such as Latency and health monitoring. The details of CPU utilization are illustrated in figure 14.

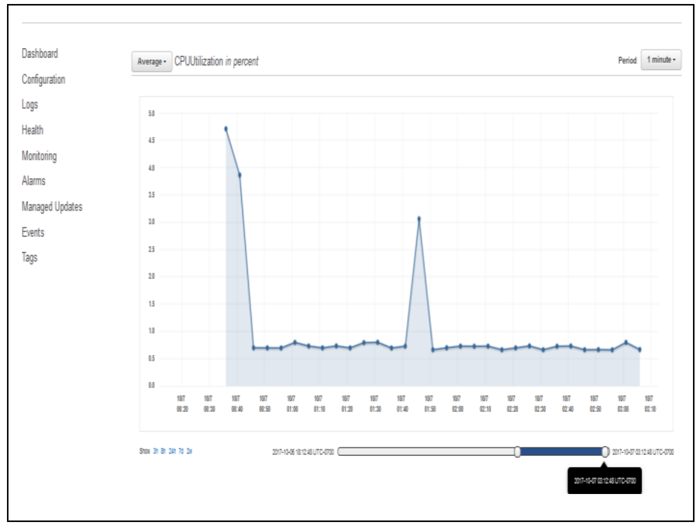

Figure 14. CPU utilization with average network traffic.

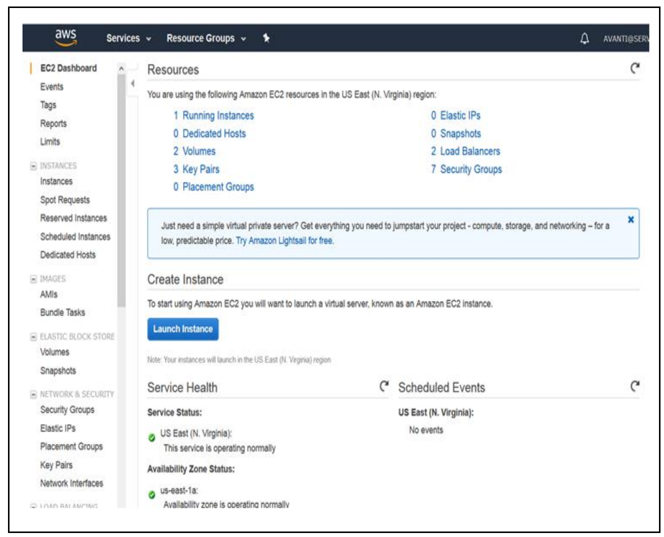

Figure 15. Cloud Hosting Dashboard representing 2 Load Balancing Servers on 1 Instance.

After the balancing of servers the Logs of the balanced server Load is then generated as the outcome. The Round Robin Routing Algorithm effectively distributes the network load over servers. The balanced logs after the balancing of servers virtually are then recorded to carter Load Balancing of servers. Figure 15 shows the details of the server rented at a lease over the cloud.

4.3 Health Monitoring of Cloud Server

The Health monitoring of servers is automatically done as a backend process after the Application is deployed over the cloud. Amazon Web Services (AWS) offer an entire Big Data services for vendors and researchers at a lease. Health monitoring of Servers over a Cloud network is a powerful feature of this private cloud while experimenting with Load Balancing of servers.

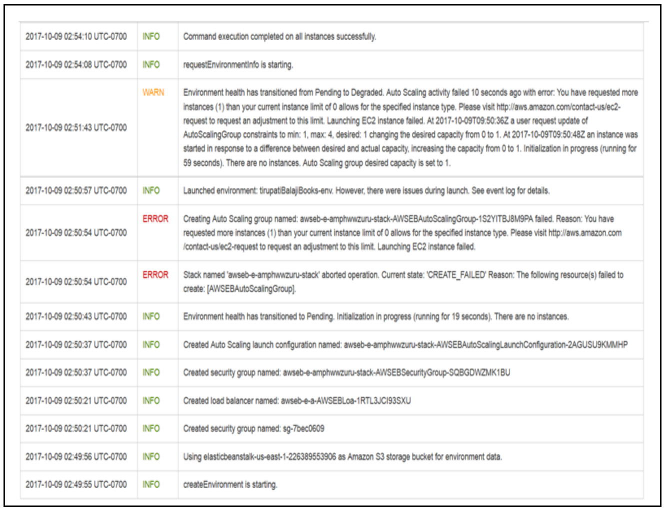

Figure 16. Noted Health Check-up of Server 2 after Deployment.

Figure 16 and Figure 17 illustrates the server health check-up prior and after a transaction is made. The server monitors throughout the time server has logged in until logged out.

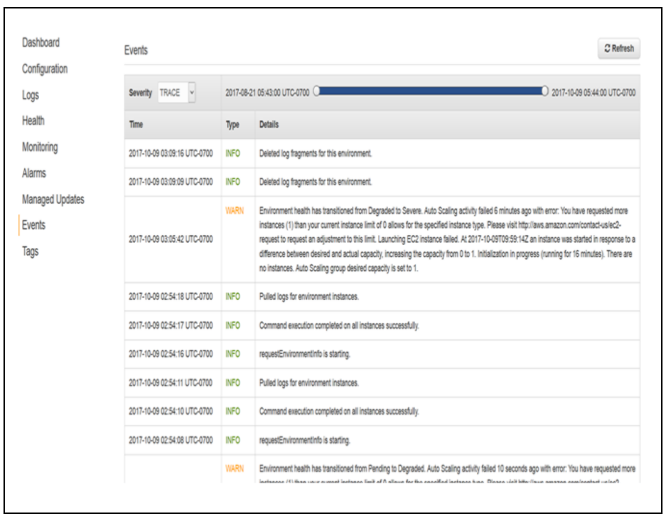

Figure 17. Noted Health Check-up of Server 2 after a Transaction.

V. Results and Discussion

The authors have found that the final result of the balancing of server load is obtained as shown in Figure 18, describes the environmental health monitoring of two individual servers hosting two individual real time applications is the result achieved by a definitive approach.

The severe condition of servers shows the balancing of load on both the servers during high network traffic, when the threshold of one server is marked at a certain cut-off of 70 per cent to avoid overloading of data, the remaining 30 per cent of the load/network traffic will be directed to the other server (i.e. server2 or an active node in a network) on the cloud or network, Thereby balancing the load on servers.

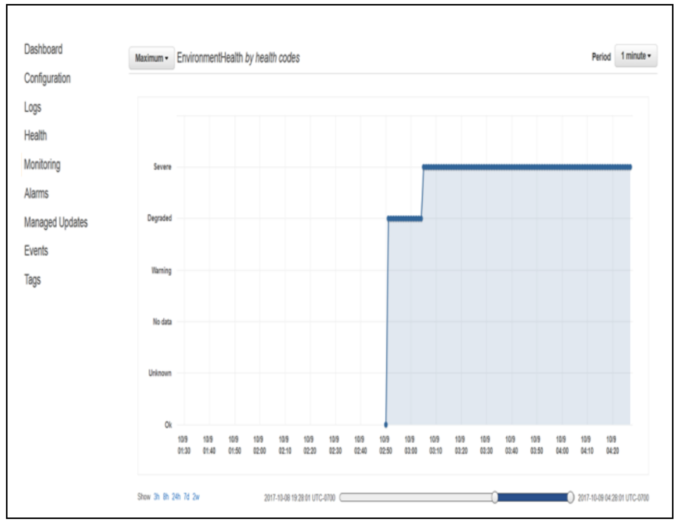

Figure 18. Result noted Server Load Balanced with per cent.

The degraded condition labeled in Figure 18 shows the condition of server when the network traffic is too low to be transferred to the other server in a network. The warning label and no data label condition shows the warning if any and when no data when the server is turned off.

VI. Conclusion and Future Scope

On the basis of result it is concluded that The Load Balancing of two separate servers running on one single instance was successfully performed with close approximation and the final Balanced Graph is generated (as shown in Figure 18). By using Round Robin Routing Algorithm It is found that the balancing of Multiple Applications can be hosted on a single instance of both the servers using Network Load Balancer (NLB) feature in Amazon Web Services (AWS) the Elastic Load Balancer (ELB) thereby manages the over work of the servers operating actively in the network with rapid increase in the network traffic. Furthermore it is to be noted that the balanced logs are generated after the analysis of Load Balancing on the Virtual Network. The services offered by Amazon Web Services (AWS) include all the three major services on four types of Cloud Deployment Model equivalently stated in this paper [5].

We executed their draw nigh by hosting the two web applications on same instance; each application can handle a maximum capacity due to multi-threading. The scope of this project is assumed to have infinite applications in the field of Information Technology, Cloud Services, Big Data and Data Sciences.

This project work may be utilized in M.R.S.A.C for offering "Web Services in Public Domain to cater the remote sensing and GIS applications to the end users" in near Future. We are confident that the contribution to the community will capacitate a reinvigorated deviation for educationalists to betroth virtual cloud service for learning and make exact trials to introduce novelties by excluding stumbling-block.

ACKNOWLEDGMENT

The prearranged investigation work presented in this paper is a touchstone performed in the research lab of Maharashtra Remote Sensing and Application Centre (M.R.S.A.C) Nagpur, Maharashtra (INDIA).

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