



## LOAD BALANCING OF WEB SERVERS - REVISITED

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### ABSTRACT

The increasing number of users on the Internet platform has led to great innovations. Over the years, we have seen development of technologies such as cloud storage and cloud computing along with various web-based services such as social media and e-commerce have flourished not just due to increasing number of internet users but also rising demands from the users. These services have now reached the epitome of convenience for the users that cannot imagine a life without these services. With the number of people accessing these web portals and web pages increasing every day this has led to an enormous strain been put on the web servers and the various infrastructure that supports these services. Therefore, the maintenance of the integrity of the services being provided is an extremely necessary component of user satisfaction. The survey of related work on load balancing on web applications indicate certain drawback such as high computational complexity and low accuracy, is driving force in our proposed methodology.

**Keywords:** Web servers, Load Balancing, Distributed Servers

### 1. INTRODUCTION

The technological advancements and improvements have also been beneficial in improving the quality of life over the past years. Technology has allowed us to have efficient and effective communication which is vital for the overall wellbeing of a human being. Technologies have also improved our lives by making innovations and products that make life easier and more convenient. There are a large number of researchers that are working on improving the existing Technologies so that they can have a larger impact on the quality of life being experienced by the people. The improvement in the living conditions of individuals all around the world is a testament to the efforts of the researchers that have to enhance the technology to meet the rising demand effectively.

One of the greatest inventions of the modern world is the introduction of the planet-wide network called the internet. The internet has facilitated an effective form of communication between individuals across the globe. The internet was first invented to allow researchers to share valuable information and other data to accelerate the growth of inventions and improve the quality of research. Over the years the internet which was a very small network across the United States has grown to massive length and currently connect the entire world through the use of number of servers and connection facilitated by underwater Optical Fiber connection.



The internet paved the way for even greater innovations to follow which have been vital in achieving the kind of enhancements improvements and technological growth that we see today. The improvements in the electronic devices and the manufacturing processes that achieve these devices have led to decreasing the cost of ownership of these electronics. The increasing affordability of these smartphones has led to a large number of individuals being able to have access to such devices. Which in turn has led to an increasing number of users being connected together to the internet platform through these electronic devices.

There have been a number of techniques that have been realized for the purpose of achieving effective load balancing. The approaches have varied ways to achieve this, with optimization techniques such as ant colony optimization and other techniques such as honey bee optimization for effective load balancing. There are also machine learning approaches such as fuzzy ANN, LSTM, and RNN etc. that achieve improved execution for web server load balancing but with deeper networks there is an issue with increasing computational complexity which needs to be managed effectively.

The increase in the concurrent request for the services along with the Very high demand has the potential to put an enormous load on the web servers. If the number of users keeps increasing as projected [8] this could lead to massive differences in the service being offered and could also lead to the inability of the service to reach the customer. This can lead to increased customer dissatisfaction that is highly problematic for an organization. Therefore, to improve the services there is a need for an effective load balancing approach that can be implemented to handle such a massive number of users concurrently. This article aims at analyzing several aspects on load balancing, proposed by the researchers in this research survey article. These approaches have been highly useful in approaching our design for an effective load balancing algorithm for a web page or a web server effectively.

This literature survey paper dedicates section 2 for analysis of past work as a literature survey, and finally, section 3 concludes the paper with traces of future enhancement.

## 2. LITERATURE SURVEY

Nidhi Verma et al. [1] explains that there has been an increased amount of innovation that has been noticed in the IT sector in recent years. This innovation has led to the creation of a variety of services that provide an important utility for users. The utilities described above which contains the services provided by the internet such as cloud service, social media, VOIP, and E-commerce, is highly convenient as it can increase the convenience and ease of operation for a variety of users (organizations, individual users, small businesses, mobile users, etc). But due to an increased user base, these approaches as described above which contains the services provided by the internet such as cloud service, social media, VOIP, and E-commerce, have been vulnerable to a lot of setbacks. Therefore, to ameliorate this effect and provide an increased quality of service to the users the authors in this paper proposed the use of heuristic load balancing algorithms. There is a lack of Quality-of-Service parameters that are utilized for the purpose of enabling an effective load balancing approach. The described methodology in this paper uses Ant colony optimization for load balancing through the



implementation of Quality-of-Service parameters such as, Throughput, overhead, migration time, resource utilization etc.

SonuSahu et al. [2] expresses that there has been an increase in the number of internet users that have been utilizing the internet platform for various approaches. An increase in the user base of the internet platform has led to the creation of innovative services that are offered on this platform. One of the most innovative services offered by the internet platform is the cloud computing approach. Cloud computing can effectively outsource the computational demands and needs of the user on to a remote server through the connection of the internet. This allows let Reliance on local computation approach for an individual as well as organizations. But there is a problem that is being seen over the past few years is the effect of a lot of users accessing the platform at the same time causing load balancing issues. For this purpose, the authors have proposed the use of an effective load balancing algorithm for the cloud computing approach. This implementation lacks a dynamic approach towards the load balancing problem.

Nissankara Lakshmi Prasanna et al. [3] introduces the paradigm of cloud computing as one of the most useful and effective approaches that have been created out of the internet platform. The cloud computing approach is nothing but a web-based computational service that is offered through the internet. But due to the increase in the popularity of this approach, there has been an increase in the number of uses which has led to the cloud unable to perform at its best for every user. To provide a solution to this problem a collection of load balancing approaches and strategies have been discussed in this research article. These approaches have only been discussed without any effective implementation.

Haiying Shen et al. [4] elaborates on the increased popularity of the cloud computing approaches due to the increased inconvenience that is offered by this platform to the users. Increase inconvenience has been responsible for the increased user base cloud computing web portal. With the popularity of these web pages, I would like to certain unique problems such as issues with the load balancing approaches. The conventional techniques for load balancing I have not been able to effectively utilize the resources on these web pages. For this purpose, authors in this research have proposed the use of rail which is a resource-intensive aware load balancing approach proposed in this paper. The authors in this paper have not calculated the overhead achieved in the proposed technique to realize the true efficiency of the approach.

Venkateshwarlu Velde et al. [5] narrates that there has been a significant increase in the number of cloud computing approaches and other web pages on the Internet platform. This is due to the characteristics of the cloud platform which make it easier and highly convenient for the users. This has inordinately caused a lot of issues on the cloud platforms as most of these services are available to effectively balance the load that is being exerted on these web pages. The conventional approaches for load balancing have been unable to keep up with the significant increase in the load. Therefore, to provide an effective and useful technique for load balancing the authors have proposed an advanced algorithm that implements fuzzy techniques for highly accurate load balancing. The implementation of fuzzy logic is highly useful as an effective segregation approach in this paper.

Mohammad Farhoudi et al. [6] explains that the conventional approaches for load balancing in web servers are less than optimal. Due to the constant increase in the number of users on the internet the ever-evolving nature has been getting increasingly difficult to handle. The increasing load on this webserver has been instrumental in



reducing the quality of the service being offered by the software-defined networks on the webserver. Therefore, to improve this approach a scheduling algorithm that is Programmable and highly flexible is being proposed in this research article. This implementation lacks the use of an effective approach for the improvement in the scalability. Network throughput and response time.

JörgLenhardt et al. [7] expresses that in recent years there has been a shift in the thinking of the majority of individuals that have been shifted towards being energy-aware. This type of mentality can be attributed to the negative environmental impact and the rising cost of energy that is being noticed all over the world. As the majority of the world utilizes fossil fuels this has led to a lot of individuals being energy-aware in their approaches. Therefore, for this purpose, the authors in this approach have proposed the use of an effective load balancing technique that is energy efficient in its approach to be implemented on the webserver. The main limitation of this approach is the lack of a prediction technique for the purpose of enabling preemption future loads.

Guoqing Liu et al. [8] elaborates on the increase in the number of e-commerce websites and social media platforms that have been effective in increasing the number of users on the Internet platform. Such a large number of individuals and provide an effective service to all of them cluster web server one of the most useful Infrastructures on the Internet platform. These cluster web servers are highly useful for providing on-demand access to various services and handling network traffic. To improve the load balancing of these cluster web servers the authors have proposed the use of a modified round-robin approach that is based on the content of the request. There has been an increased computational complexity that is not been checked by the authors.

Jie Li et al. [9] introduces the concept of load balancing which has been becoming highly important nowadays as the internet has been subjected to an exponentially increasing network traffic. This network traffic is highly difficult to cope with on the webserver due to a significant increase in the concurrent request. As the web servers need to maintain the throughput there is the need for an innovative load-balancing algorithm. To fulfill this need, the researchers in this paper have proposed the use of consistent hash to achieve a dynamic load balancing algorithm. The main limitation is that the authors have overburdened the Virtual Environment which handles the load distribution.

Fatma Mbarek et al. [10] narrates that web server and web clusters are one of the most important Infrastructures of the internet platform. These Structures are responsible for handling the various requests and demands of the user on the web page. There is also been an increase in the utilization of distributed systems for the purpose of fulfilling the concurrent request and other demands. This has warranted the use of an effective technique for the proper schedule and load balancing to optimize the execution. Therefore, the authors have proposed the use of the honey bee algorithm, along with the ant Colony Optimization algorithm for the purpose of Metaheuristic approaches for load balancing in heterogeneous web clusters. The techniques in this paper have only been discussed and not implemented effectively which is a major limitation achieved.

Prachi Shukla et al. [11] explains the technique of load balancing which balances the load that is being placed on a web server by distributing the service request across a number of web servers. The load balancing is necessary to achieve proper fulfillment of the requests being received on the webserver. This fulfillment of the request is highly essential to maintain the quality of service for the various users of the webserver. Due to the



increase in the number of users on the Internet platform the traditional approaches for load balancing have been adequate for this task. Therefore, the authors in this approach proposed the use of replicated web service for the purpose of CLUE based load-balancing. The main drawback of this approach is that the authors have not handled the external load for the purpose of load balancing.

MochamadRexa Mei Bella et al. [12] expresses that the internet is one of the most essential parts of life in this information age. There are a plethora of services that are being offered through this platform that are highly essential and almost irreplaceable now. The web servers are the main entities of infrastructure that provide just services and support the internet platform. Due to the large number of users accessing this web service every day this increases the chances of errors and other loss of data on the web servers. These inconsistencies in the web service can affect the web application and web pages negatively. Therefore, to improve this drawback the portals in this approach have proposed the use of Docker Swarm for the purpose of memory utilization for load balancing on the webserver. The approach only decreases the possibilities of a single point failure in the cluster which is a major limitation.

I Putu Adhi Suwandika et al. [13] explains that technological innovations and the increasing development in the IT sector has increased the amount of Information and the demand for this information access. The internet facilitates the communication and sharing of data in a large-scale manner. This increases the number of users being attracted to the internet platform for achieving their information and accessing services on the web pages. This puts an unfair load on the web servers that provide this information and support the services on the Internet platform. Therefore, to release the web servers and increasing the performance of the software-defined networks is defined in this research. The authors have suggested the use of IP hashing approach to achieve better performance in the web servers.

Deepti Sharma et al. [14] elaborates all the increasing popularity of web-based applications that have been responsible for the massive growth in online companies. These industries have very high demand as the web pages are highly popular for a large number of users. This high demand is serviced by the webserver which is responsible for handling the request and providing adequate services to the users. These birds and inadequate train on the web servers need to be balanced by a load balancing approach. For this purpose, the authors in this approach have proposed the use of an effective response time-based load balancing approach for applications in the clustered web server. The performance analysis of the approach revealed an increased complexity as the authors have only concentrated on the reduction of the response time on the web server.

Zhijie Han et al. [15] narrates that with the immense popularity of web streaming and other Web Services there have been a large number of users that have been concurrently accessing or requesting access to these web applications. For this purpose, a large number of Web clusters are deployed to process the demands and the increasing request by the users. The objective of using web clusters is to reduce network latency and provide an effective service to users. Therefore, to improve this approach the authors have provided a strategy for Web Load balancing which is based on energy consumption and constrained on the DNS collaboration of the cluster. The prediction approach is highly vital as it enables an effective framework that can be useful in the design of our methodology effectively.



The Table given below illustrates the comparative evaluation of the predominant techniques which have been instrumental in achieving the proposed approach.

### 3. CONCLUSION AND FUTURE SCOPE

Paper	Technique/Algorithm Used	Strength	Weakness
<b>S. Sahu et al. (2019)</b>	Cloud computing, Virtual Machine, Load balancing algorithm, Data Centre Controller.	Cloudism, simulations, load balancing, Virtual Machine Allocation and cloud computing approaches have been elaborated.	This implementation lacks a dynamic approach towards the load balancing problem.
<b>N. L. Prasanna et al. (2018)</b>	Wheel Graph, Anti-magic Labelling, Magic Labelling, Job response time, Resource utilization, Load Balancing.	A collection of load balancing approaches and strategies have been discussed in this research article.	These approaches have only been discussed without any effective implementation
<b>V. Velde et al. (2017)</b>	Response time, processing time, load balancing and fuzzy based round robin are considered for the algorithm.	The implementation of fuzzy logic is highly useful as an effective segregation approach in this paper.	The approach only been evaluated in a simulation environment which is a limitation of this approach.
<b>J. Lenhardt et al. (2017)</b>	Power efficiency, load balancing, web servers, effective improvement in the reduction of energy consumption through load balancing.	The authors have only considered the impact of energy consumption of the web servers and the correlation of the server load on the web server.	The main limitation of this approach is the lack of a prediction technique for the purpose of enabling pre-emption future loads.
<b>J. Li et al. (2018)</b>	The researchers in this paper have proposed the use of consistent hash to achieve a dynamic load balancing algorithm.	The authors have effectively evaluated the approach for achieving a dynamic technique for the effective load balancing.	The main limitation is that the authors have overburdened the Virtual Environment which handles the load distribution.

The approach for effective load balancing is one of the most important implementations in the recent years. There has been an inordinate increase in the number of individuals accessing the internet platform. This has been in turn due to the technological advancements in the paradigm of electronic devices. The advancements



have led to the improvement in the affordability of the devices which has increased the internet users in the recent years. This has been facilitating the increase in the concurrent requests being performed for various web applications and webpages. The traditional approaches for the purpose of enabling and effective and useful load balancing techniques are not adequate to achieve the improvements in the user satisfaction.

Therefore, for this purpose some research papers on the topic of load balancing have been scrutinized in this article. This scrutiny has enabled the design of our methodology for the effective load balancing which will be detailed in the future editions of this research.

The researches have been instrumental in showing that some of the approaches work and the other have been with some or the other tradeoffs, as evident in the concluding remarks of each literature survey.

## REFERENCES

- [1] N. Verma, V. Sharma, M. Kashyap and A. Jha, "Heuristic Load Balancing Algorithms in Vulnerable Cloud Computing Environment," 2018 International Conference on Advances in Computing, Communication Control and Networking (ICACCCN), Greater Noida, India, 2018, pp. 424-429, doi: 10.1109/ICACCCN.2018.8748640.
- [2] S. Sahu and M. Pandey, "Efficient load balancing algorithm analysis in Cloud Computing," 2019 International Conference on Communication and Electronics Systems (ICES), Coimbatore, India, 2019, pp. 779-783, doi: 10.1109/ICES45898.2019.9002248.
- [3] N. L. Prasanna and P. J. Jyothi, "Load Balancing Strategies in CLOUD an Application of Magic Labeling," 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018, pp. 1659-1664, doi: 10.1109/ICCONS.2018.8663105.
- [4] L. Chen, H. Shen and K. Sapra, "RIAL: Resource Intensity Aware Load balancing in clouds," IEEE INFOCOM 2014 - IEEE Conference on Computer Communications, Toronto, ON, Canada, 2014, pp. 1294-1302, doi: 10.1109/INFOCOM.2014.6848062.
- [5] V. Velde and B. Rama, "An advanced algorithm for load balancing in cloud computing using fuzzy technique," 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2017, pp. 1042-1047, doi: 10.1109/ICCONS.2017.8250624.
- [6] M. Farhoudi, P. Habibi and M. Sabaei, "Server Load Balancing in Software-Defined Networks", 2018 9th International Symposium on Telecommunications (IST), Tehran, Iran, 2018, pp. 435-441, doi: 10.1109/ISTEL.2018.8661114.
- [7] J. Lenhardt, K. Chen and W. Schiffmann, "Energy-Efficient Web Server Load Balancing," in IEEE Systems Journal, vol. 11, no. 2, pp. 878-888, June 2017, doi: 10.1109/JSYST.2015.2465813.
- [8] G. Liu and X. Wang, "A Modified Round-Robin Load Balancing Algorithm Based on Content of Request," 2018 5th International Conference on Information Science and Control Engineering (ICISCE), Zhengzhou, China, 2018, pp. 66-72, doi: 10.1109/ICISCE.2018.00023.
- [9] J. Li, Y. Nie and S. Zhou, "A Dynamic Load Balancing Algorithm Based on Consistent Hash," 2018 2nd IEEE Advanced Information Management, Communicates, Electronic and Automation Control Conference (IMCEC), Xi'an, China, 2018, pp. 2387-2391, doi: 10.1109/IMCEC.2018.8469341.

- [10] F. Mbarek and V. Mosorov, "Load balancing algorithms in heterogeneous web cluster," 2018 International Interdisciplinary PhD Workshop (IIPHDW), Świnouście, Poland, 2018, pp. 205-208, doi: 10.1109/IIPHDW.2018.8388358.
- [11] P. Shukla and A. Kumar, "CLUE Based Load Balancing in Replicated Web Server," 2018 8th International Conference on Communication Systems and Network Technologies (CSNT), Bhopal, India, 2018, pp. 104-107, doi: 10.1109/CSNT.2018.8820224.
- [12] M. R. M. Bella, M. Data and W. Yahya, "Web Server Load Balancing Based on Memory Utilization Using Docker Swarm," 2018 International Conference on Sustainable Information Engineering and Technology (SIET), Malang, Indonesia, 2018, pp. 220-223, doi: 10.1109/SIET.2018.8693212.
- [13] I. P. A. Suwandika, M. A. Nugroho and M. Abdurahman, "Increasing SDN Network Performance Using Load Balancing Scheme on Web Server," 2018 6th International Conference on Information and Communication Technology (ICoICT), Bandung, Indonesia, 2018, pp. 459-463, doi: 10.1109/ICoICT.2018.8528803.
- [14] D. Sharma, "Response Time Based Balancing of Load in Web Server Clusters," 2018 7th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India, 2018, pp. 471-476, doi: 10.1109/ICRITO.2018.8748373.
- [15] Z. Han, Y. Wang and H. Zhao, "Web Load Balance Strategy with Energy Consumption Constrained Based on DNS Collaboration," 2018 IEEE 4th International Conference on Big Data Security on Cloud (BigDataSecurity), IEEE International Conference on High Performance and Smart Computing, (HPSC) and IEEE International Conference on Intelligent Data and Security (IDS), Omaha, NE, USA, 2018, pp. 55-58, doi: 10.1109/BDS/HPSC/IDS18.2018.00025.

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