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# A study of novel fault tolerance approaches for load balancing in the cloud computing

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**Abstract**
Over the last few years, cloud computing (CC) has emerged as a new industry standard. CC plans to use dynamic utility provisioning to make computation and properties available online. There are numerous interactions and issues related to CC implementation. The primary focus of this research article is load balancing (LB), which is one of the fundamental issues with CC. The research paper also goes into great length about the issues that LB is facing in the current CC environment. It shows that a new LB algorithm approach involving fault tolerance (FT) measurements is required.

## 1. Introduction
Cloud computing has emerged in recent years as a cutting-edge concept. It has facilitated the development of a distributed system into a massive computing network. Cloud computing companies including IBM, Amazon, Yahoo, and Google provide cloud services to users worldwide. End users are not obliged to install programs on their PCs using this novel strategy. Instead, end consumers can access and receive the apps and services whenever they want.
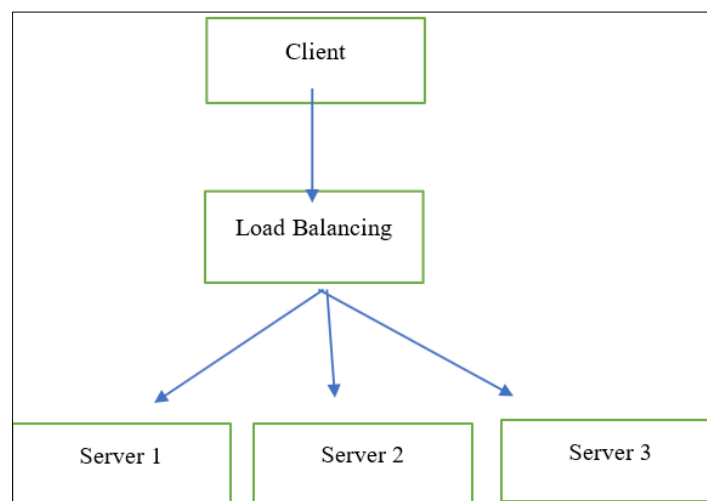
**How Load Balancing**



**Fig 1:** Cloud computing load balancing

## 2. Background
### Cloud Computing History
Along with other lines and versions, cloud computing has evolved technologically since the 1960s. Web 2.0 is the most recent and sophisticated progression of them all.

The launch of Salesforce.com in 1999 was one of the early and most significant turning points in the history of cloud computing. The idea of carrying and delivering enterprise applications has been introduced by it. It's accomplished via a basic webpage.

Amazon Web Services (AWS) was the next development stage in 2002. A range of cloud-based services were made available, all completed using Amazon Mechanical Turk. It consists of:

- Storage
- Calculation
- The intellect of humans

Amazon introduced its Elastic Compute Cloud (EC2) in 2006. This online service is for sale. It enables people and small businesses to rent computers.

The first broadly accessible cloud computing infrastructure service is Amazon EC2/S3. TV stations and newspapers in the UK have been using its SaaS online video platform. When Web 2.0 gained traction in 2009, Google began to release browser-based business apps such as Google Apps.

### Characteristics of Cloud Computing
Cloud computing, as defined by the US National Institute of Standards and Technology (NIST), is "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".

This description lists the following five key elements of cloud computing: • On-demand self- service. Access to a large network.

- Pooling of resources.
- Quick elasticity.
- Measured Service.

### Cloud computing and load balancing challenges
There have been some obstacles in the way of comprehending the cloud environment. Load balancing is a key problem or issue among those challenges. It is described as the process of dividing the load among several machines.

It implies that the required load will be distributed among several computer solutions and their clusters, i.e., on different servers, network lines, disks, etc.

## 3. Research Problem
### The goal of the Research
The following are the main objectives of this study paper:

- To determine the main obstacles in cloud computing.
- To examine various load-balancing strategies that have been suggested.
- Determining whether a new policy for fault tolerance-based load balancing is necessary

### Sources of Data
Several data sources were taken into consideration for this survey. Research papers from journals and conferences are taken into account. Books, periodicals, blogs, Google Scholar, and research articles from Scopus are all used as databases to extract topic-related information.

## 4. Solution and Discussion Cloud Computing's Challenges and Solutions
With this approach, there are several interactions. The following are the CC's main issues:

- **Data protection**

Data protection is an important factor that must be considered. Confidentiality is a problem as the data is stored on cloud servers. In the majority of current models, data centers and firewalls pose a threat to knowledge.

- **Availability and Recovery of Data**

It is yet another crucial matter. The operational staff plays a major part in this situation. They are in charge of running system time management and service level agreements.

- **Capabilities in Administration**

**It is essential. First things first for CC:**

- Infrastructure management
- Network transformation
- The ability to scale dynamically
- Allocating resources dynamically across many companies.

- **Regulation and Limitations**

On Compliance Storage space must be established by the service providers as well. Mainly within the nation, compliance with rules and requirements is necessary. Having such an infrastructure might not always be possible. It's a significant test that cloud providers presented.

- **Safety**

Cloud security is related to many different laws, technologies, and applications. They manage its utilization to safeguard its virtuality. Digital identities, usernames, and passwords need to be protected for this reason.

- **Able to Modify the Assignment**

Every stack's core is traversed by the tension adjustment. Additionally, this raises the output of the device. Several recent numbers provide an efficient use of resources and a tweak to the stack.

- **Managing Executions**

Infrastructure, Device, and Application levels comprise the three tiers of execution control. The network connections are established using the first two parts. They collect information from several agencies dispersed over the cloud. The portion of data processing that sets up and causes items based on specific conditions is the third component.

- **Equilibrium of load**

The CC has a significant problem with load balancing. The QoS metrics—cost, response time, dependability, efficiency, and resource usage—may be enhanced by LB.

- **Tolerance for Faults**

FT is among the most important variables. Thus, the following tasks necessitate a fault tolerance strategy:

identifying errors.
- fixing errors
- strengthening the rules for performance.

- **Governance of Cloud Computing**

In the last ten years, cloud computing has gained widespread acceptance and usage. One may consider cloud computing governance to be under the overall IT management purview.

- **Compatibility**

In this case, one approach ought to be able to include resources from the opposing sides. We refer to this as interoperability. Web services and are becoming possible, however, creating these web services requires a lot of work.

- **Mobility**

Because each cloud provider uses a separate standard language for its framework, portability is possible.

**The Prospects of Load Balancing**

Using energy and computational resources efficiently has become a major challenge. The exponential growth in demand for cloud services is the cause of it. LB contributes to the improvement of

- Resource efficiency
- Quality
- Reduction of energy

This is accomplished by distributing the load among numerous computing machines in the data center in an even manner. The investigated algorithms are found to generally increase resource operation and energy protection.

so, there's a great deal of room for growth. More capable and flexible LB algorithms should be developed in order to increase and enhance resource efficiency, energy protection, and output. Their mission is to deliver exceptional services to clients at the most affordable price. Traffic regulation between quick activities and effective resource use will be possible with adaptive lambda.

It entails combining distributed and centralized control mechanisms. Energy conservation is a key component of economic expansion. It led to a rise in resource use. Resulting in a decrease in the gathering of resources.

Thus, novel approaches that necessitate load balancing according to energy usage, carbon emissions, and support expenses show great promise. It is suggested that a number of meta-heuristics be tried in real-world systems as a possible course. These approaches rely on PSO or ACO methodology. It illustrates the ways in which they could be used in an actual cloud system. In order to get around the constraints of the algorithms in use today, the following work might be completed in the future.

**5. Conclusion**

The main issues and difficulties surrounding cloud computing are the subject of this article. Modern computer technology that provides 24/7 customer service is called cloud computing.

One of the main issues pertaining to the CC scenario is LB. Using this method of overloading a gadget might have such horrible consequences that it can make technology useless. Therefore, an efficient LB algorithm is always needed for

resource utilization. By spreading the workload across several network nodes, optimizing resource utilization, and increasing device efficiency, LB seeks to meet user demands As a result, efficient load management is essential for reaction time minimization, resource utilization, system dependability, and throughput optimization. This study outlined the various load-balancing methods for LB, including dynamic, static, and dynamic load- balancing algorithms that are inspired by dynamic nature.

New dynamic LB algorithms that are entirely autonomous will be required in the future.

**It will make the following possible**:
- Improved resource utilization
- The smallest make-span
- A higher degree of mismatch
- Efficient transfers of tasks
- The shortest possible duration.

The technology behind CC is robust and will endure for many years. It is among the most significant and excellent inventions. We can use it to carry out the most important and vital tasks for the business. Long-term improvements will be made to CC via the aforementioned developments.

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