INTERNATIONAL JOURNAL OF TECHNO-ENGINEERING
IJTE

ISSN: 2057-5688

SOURCE OPTIMIZATION LOAD BALANCE USED FOR PROCESS IMPROVEMENT IN THE CLOUD COMPUTING ENVIRONMENT

Daruru Sarika, Research Scholar, Department of Computer Science and Engineering, Monad University, Hapur, U.P.

Dr.Amit Singhal, Professor, Supervisor, Department of Computer Science and Engineering, Monad University, Hapur, U.P.

Abstract:

Cloud computing is a rapidly expanding field that enables the on-demand execution of computationally demanding activities. Its size is already very significant. There are several ways that consumers might be provided with cloud-based services, but resource management—which handles resource pooling, setup, and task scheduling—is essential. The task scheduler, a crucial part of resource management in cloud computing systems, allocates user tasks to logical resources—also referred to as "Virtual Machines" (VM)—that have been delivered via optimization methods. Since resources and activities are dynamic and diversified, cloud computing systems continue to face significant challenges with regard to effective task scheduling and equitable labor allocation.

In cloud computing, the power of parallel and distributed systems is merged. This is the first of its kind, providing IaaS, PaaS, and SaaS services on demand. Owing to its adaptability and expandability, this technology is in use today and is seeing tremendous global growth. It charges costs in the form of utility computing based on two distinct pricing models: pay-per-use and reservation-based. Public, private, community, and hybrid cloud computing are the four main categories. A few of the top service providers include Amazon Web Services, Microsoft Azure, and Google Cloud Platform. Numerous fields, including as resource management, application modeling, cloud security, interoperability, and datacenter design and infrastructure, are currently undergoing research. Among them, resource management is one of the most important and crucial areas with a lot of continuing research being done in it. Resource management assigns the resources in response to management actions. These days, the massive scalability makes resource management tough. It consists of four stages: work scheduling, resource monitoring, resource selection/allocation, and resource discovery. It is the central part of the cloud environment. Task scheduling is the time-consuming process of allocating a user's work to the resources that are available in compliance with a set of criteria. There are six categories into which it may be separated: batch mode against immediate mode, preemptive versus non-preemptive, heuristic versus metaheuristic, distributed versus centralized, cooperative versus independent, and static versus dynamic. The mapping of tasks to allotted resources, including impositions, without violating SLA is one of the complex issues in this scenario. We have thus made the decision to concentrate all of our research efforts on developing more effective work scheduling techniques.

1 INTRODUCTION

The definition of "Computing" is any action that involves running a program, which is a piece of code. To provide information meant for end users, necessary resources and system communications were needed. Over time, it has transitioned from supercomputing to distributed systems. The need and development of technologies led to the development of the following computing, which is covered below:

Extreme Computing Super-computing was born out of earlier system architectures that were designed with the sole purpose of executing very huge computational tasks at significantly quicker speeds. A supercomputer [4] is one that can carry out tasks requiring a significant amount of processing power. The New York City global broadsheet used the phrase "super computing" for the first time in 1929. The 1960s saw the introduction of supercomputers. Seymour Cray of the CDC, which would eventually become Cray Research, created it. The CDC-6600 was the first product, released in 1964. The 2013 Cray "Titan" supercomputer at Oak Ridge National Lab is one example of how researchers are progressively increasing their processing capacity, which is measured in petaFLOPS for use in various projects. Operating at 17.50 petaFLOPS, it costs 97 million US dollars. Supercomputers are utilized extensively in a broad range of applications that need massive processing power, such as weather forecasting, stock market analysis, metal strength, oil and gas explosions, modeling multiple entities, nuclear research, and almost all scientific and technical challenges.

In parallel processing Parallel computing was another advancement in computing that sparked a revolution across the whole IT sector [5]. It was originally unveiled in 1958, and the D825 was the first official product to be released in 1962. It operates by breaking down a given issue into a number of jobs based on graining, all of which are then carried out concurrently. The idea behind parallel execution is that large tasks may often be divided into smaller modules as needed, which are then executed concurrently by similar but stronger resources. Bit level to instruction level or data level to task level are two examples of parallel execution. An actual example of something inspired by parallel computing is instruction pipelining. Older computer programs were created and programmed for serial calculation; but, with the advent of parallel computing, these programs were quickly superseded by parallel ones, which allow for the simultaneous processing of numerous tasks. The rapid innovation and growing use of multi-core processors and Graphical Processing Units has brought the paradigm to the forefront and made it a technical blessing for the rest of the globe. GPUs and CPUs work together to increase an application's data speed and number of concurrent computations. Even with all of its advantages, there are still certain areas where it falls short, such as the programmer's inability to regulate concurrency, the difficulty in determining the appropriate level of granularity—both in terms of hardware and software scalability.

Individual Processing It was created in the early 1960s as a result of one of the major projects, ARPANET. Its whole foundation is a distributed system, in which several computers linked globally through a communication network use the message forwarding mechanism [1].

Distributed computing's ultimate purpose [7] was to achieve a shared objective as much as possible to enable resource sharing. Through the use of wide area networks and web services, the computer components of a distributed system may be linked together as physically closed units and either locally or geographically distant [2]. It validates the many configuration types that correspond, on occasion, with parallel computing and its paradigm. Creating a network that functions as a single computer is the goal of distributed computing. The primary benefit of such computing is that it provides redundancy and scalability, which in turn enhances reliability—a feature that centralized systems sometimes lack. Because of the progress made in communication and device interconnection, this design is still in use and has gained popularity as a solution to a variety of challenges from many fields. Due to its intrinsic qualities, it has a broad variety of uses, making it a solid candidate for selection. The drawback is that, as said in distributed systems, it requires effective algorithms and programming approaches to disperse a task.

2 LITREATURE SURVEY

Cloud computing is a modern buzzword that combines the strengths of distributed and parallel computing. Different types of virtualized resources that are dispersed across diverse locales are dealt with in cloud environments. So, it takes considerable work to plan and distribute resources effectively. Resource discovery, resource selection, task scheduling, and resource monitoring are some of the steps under resource management of cloud computing that need such efforts. Among them, scheduling is a crucial Cloud element that falls under the umbrella of resource management. It may be seen as the process of determining the best way to distribute a collection of tasks, or meta-tasks, among the pool of available resources in order to achieve desired outcomes [3]. Since it is the critical step that allotted resources to mapped tasks, also called cloudlets, depending on the many cloud environmental criteria that are enforced for improved overall performance. Tasks that are not scheduled effectively result in underutilized resources, which raises completion times and degrades system performance. Scheduling is thus always seen as the central component of resource management.

The thesis focuses on the several heuristic techniques that have been developed and the numerous research projects that have been conducted on task scheduling issues in cloud computing in recent years, all based on distinct Quality of Service (QoS) viewpoints. The majority of these initiatives are focused on enhancing performance, such as reducing makespan and effectively using cloud resources for the advantage of both cloud providers and consumers. As mentioned in Panda Sanjaya K & Prasanta K Jana (2019), one kind of NP-complete issue in cloud computing is work scheduling. According to Tsai & Rodrigues (2014), the results of earlier research projects demonstrate that heuristic-based algorithms were more appropriate than standard algorithms. This chapter covers in-depth research studies on several job scheduling algorithms for cloud computing, along with an analysis of their performance.

According to Mandal & Acharyya (2022), task scheduling problems are a kind of NP hard problems for which typical scheduling algorithms cannot be appropriate for the best solution since the running duration is unpredictable. Furthermore, a defined population size and predictable operating duration are prerequisites for the old approach's superior performance. These optimization issues often include limited capacity, imprecise information, and missing information. Therefore, by using random selection and looking for the best answer, meta-heuristic based approaches may be employed to tackle optimization issues.

According to Amir Hossein Gandomi et al. (2021), the term "meta" in these algorithms indicates "higher level" and offers a superior answer when compared to the conventional algorithms and basic heuristics. Usually, these algorithms are based on local search and randomization. The process of randomization results in a good answer by shifting the focus from local search to global search. For this reason, computation and global optimization are often appropriate uses for the majority of meta-heuristic algorithms. The challenge of task scheduling is rooted in combinatorial

ISSN: 2057-5688

optimization, whereby a vast set of workable solutions must be searched; meta-heuristic algorithms are more suited to handle this kind of problem than others.

A growing body of research on combinatorial optimization issues is focused on nature-inspired algorithms, which form the basis of several meta-heuristic algorithms. These techniques have recently shown improved performance while handling high-dimension nonlinear optimization problems. Its strong points enable it to effectively address NP-hard issues like task-resource assignments and other optimization issues as it can completely utilize the valuable data of the population to identify ideal solutions as shown.

3 METHODOLOGY

A variety of sectors and people's everyday lives in society have been impacted by intelligence as a result of the growth of an intelligent society and the ongoing improvement of people's demands. A wide range of applications for edge devices have emerged in society, including cameras, intelligent production robots in intelligent manufacturing, smart homes, and autonomous cars in the sphere of transportation. Consequently, there are now a notably higher number of devices connected to the Internet. According to Cisco's Global Cloud Index [1], there were 17.1 billion Internet-connected devices in 2016. By 2019, 10.4 Zettabytes (ZB) of data will be transferred between global data centers; 45 percent of that data will be processed, stored, and analyzed at the network's edge; and by 2020, there will be more than 50 billion wireless devices connected to the network. Global device data generation has also surged, rising from 218 ZB in 2016 to 847 ZB in 2021. According to figures from the international data corporation Internet figures Center (IDC), there will be more than 50 billion terminals and devices linked to the network by 2020, and there will be more than 40 ZB of data globally [2]. Given the diverse range of data processing needs and the steady and enormous increase in data volume, cloud-based big data processing has shown several drawbacks.

Real-time: A high number of edge devices means that a lot of terminal data must still be sent to the cloud for processing, which will significantly increase the volume of intermediate data transmission and decrease the performance of data transmission. This will put a lot of strain on the network's transmission bandwidth and cause a delay in data transmission. Cloud computing may not be able to satisfy corporate real-time needs in certain application situations needing real-time response, such as traffic, monitoring, etc.

Security and privacy: Use of different smartphone apps necessitates the provision of user data, including privacy data. This data is very vulnerable to privacy breaches or attacks after it is uploaded to the cloud center. Energy consumption: China's data centers are using a lot more electricity as a result of the country's growing smart device population. The rising demand for data energy consumption cannot be satisfied by improving the usage efficiency of cloud computing energy consumption [3]. The fast evolving intelligent society will have more energy-intensive cloud computing needs.

Edge computing has developed at a historic time because to the growing volume of data and the growing need for data processing. With the use of edge computing technologies, artificial intelligence services may be rendered for ever-expanding terminal devices and data, resulting in more reliable services. Edge computing is located near to smart terminals, which are the source of the data. At the network's edge, it handles and stores data. It offers near-end services to users and has proximity and location awareness. It processes data more quickly, securely, and in real time. It may also lower expenses and ease the strain on network bandwidth in addition to resolving the issue of excessive energy consumption in cloud computing. Many industries, including manufacturing, energy, smart homes, and transportation, use edge computing. As the Internet of Things (IoT) grows, edge computing models are becoming more and more important research topics. In order to serve as a resource for edge computing researchers, we go into great depth on edge computing in this article, including its introduction, architecture, important technologies, security and privacy, and applications.

INTERNATIONAL JOURNAL OF TECHNO-ENGINEERING
IJTE
ISSN: 2057-5688

4 EXPERIMENTS & RESULTS

single owner cloud data is built for simulation purposes by setting up a private cloud with Eucalyptus operating on a 2.50 GHz Intel ® CoreTM i5-3120M Processor and 8 GB RAM, and by using Java BigInteger library methods (Neal R Wagner 2003). Four nodes (owners) were distributed randomly into five clusters, each of which corresponded to a community. Every cloud node will produce a public key and a private key by executing the ESS_Keygen() function. Subsequently, every node will divulge its public key to other nodes inside the cluster. The security and performance investigation of the suggested ESS system has been completed using this cloud configuration. By using a number field sieve - integer factorization technique and a brute force assault, the security of the SS and the ESS is guaranteed. To get an estimate of the algorithm's overall execution time, the several performance indicators for ESS are examined.

Analysis of Performance: Variable File Size The performance of the proposed ESS cryptosystem with varied input file sizes is examined for cloud data owned by a single owner. The execution time for encryption and decryption against the Schmidt Samoa cryptosystem is compared with the proposed Enhanced Schmidt Samoa cryptosystem for single owner cloud data. For effective comparison, small input file sizes are given to SS and proposed ESS encryption and decryption vary from 8KB to 1024 KB, and the key size is kept as constant as 16 bits and 32 bits. In SS, the key value for 16 bits is taken with p=257, q=349, N=23051101, and d=19189. In ESS, the key value for 16 bit is taken with p=367, q=379, r=389, s=401, N=4099, and d=8699. Table 3.1 shows the execution time of the Schmidt Samoa cryptosystem and Enhanced Schmidt Samoa cryptosystem for single owner cloud data with key size 16 bits.

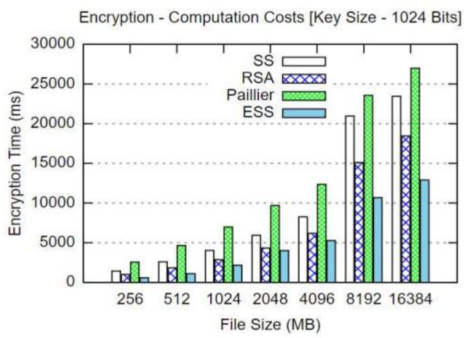

Figure 3.1 Encryption time for single owner cloud data (key size - 1024 bits)

INTERNATIONAL JOURNAL OF TECHNO-ENGINEERING
IJTE

ISSN: 2057-5688

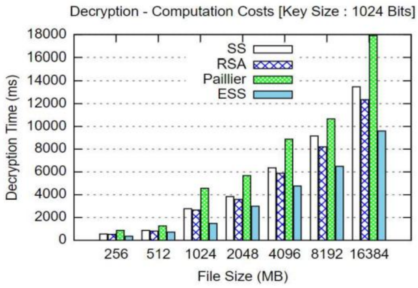

Figure 3.2 Decryption time for single owner cloud data (key size – 1024 bits)

5 CONCLUSION

Enhanced Public Key Cryptosystem: A New and Effective Approach Schmidt's A proposed cryptosystem called Samoa is meant to safeguard cloud data belonging to a single person. In most cases, data retrieval will be done after data storage in the cloud has been completed once. The outcomes of the experiment demonstrated that data secrecy in the cloud may be guaranteed by using the ESS cryptosystem. In comparison to conventional cryptosystems, the suggested ESS cryptosystem is very secure and difficult to compromise, according to the cloud configuration and testing findings. For the people using cloud-based apps and data, a safe cloud architecture has been created via this study. People may create the data and distribute it to other people who have the ability to read and write to it. In most businesses, data is shared across many users in order to support business processes. The idea has to be modified in the framework for these multi-user situations, where there are both data owners and data users. Cryptographic keys must be safely exchanged between the owners if the data is to be shared. Enhancing the architecture of the Improved Secure Cloud Data Storage architecture (ISCDSF) requires tackling critical management concerns and guaranteeing the privacy of data for many users in the cloud.

6 REFERENCE

1. Lamport L. Time, clocks, and the ordering of events in a distributed system. InConcurrency: the Works of Leslie Lamport 2019 Oct 4 (pp. 179-196).

2. Xiaohui Z, Huayong W, Guiran C, Hong Z. An autonomous system-based distribution system for web search. In2001 IEEE International Conference on Systems, Man and Cybernetics. e-Systems and e-Man for Cybernetics in Cyberspace (Cat. No. 01CH37236) 2001 Oct 7 (Vol. 1, pp. 435-440). IEEE.

3. Nadiminti K, De Assunçao MD, Buyya R. Distributed systems and recent innovations: Challenges and benefits. InfoNet Magazine. 2006 Sep;16(3):1-5.

4. Cook JS, Gupta N. History of Supercomputing and Supercomputer Centers. InResearch and Applications in Global Supercomputing 2015 (pp. 33-55). IGI Global.

5. Navarro CA, Hitschfeld-Kahler N, Mateu L. A survey on parallel computing and its applications in data-parallel problems using GPU architectures. Communications in Computational Physics. 2014 Feb;15(2):285-329.

6. Zaharia M, Chowdhury M, Franklin MJ, Shenker S, Stoica I. Spark: Cluster computing with working sets. HotCloud. 2010 Jun 22;10(10-10):95.

7. Franz J, Gerber M, Gruetzner M, Spruth W, inventors; International Business Machines Corp, assignee. Providing computing service to users in a heterogeneous distributed computing environment. United States patent US 8,140,371. 2012 Mar 20.

8. Anderson DP, Korpela E, Walton R. High-performance task distribution for volunteer computing. InFirst International Conference on e-Science and Grid Computing (e-Science'05) 2005 Jul 5 (pp. 8-pp). IEEE.

9. Motta G, Sfondrini N, Sacco D. Cloud computing: An architectural and technological overview. In2012 International Joint Conference on Service Sciences 2012 May 24 (pp. 23-27). IEEE.

10. Garrison G, Wakefield RL, Kim S. The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations. International Journal of Information Management. 2015 Aug 1;35(4):377-93.

11. Marinos A, Briscoe G. Community cloud computing. InIEEE International Conference on Cloud Computing 2009 Dec 1 (pp. 472-484). Springer, Berlin, Heidelberg.

12. Satyanarayanan M. The emergence of edge computing. Computer. 2017 Jan 5;50(1):30-9.

13. Pan J, McElhannon J. Future edge cloud and edge computing for internet of things applications. IEEE Internet of Things Journal. 2017 Oct 30;5(1):439-49.

14. Bonomi F, Milito R, Zhu J, Addepalli S. Fog computing and its role in the internet of things. InProceedings

ISSN: 2057-5688

of the first edition of the MCC workshop on Mobile cloud computing 2012 Aug 17 (pp. 13-16).

15. Stojmenovic I, Wen S. The fog computing paradigm: Scenarios and security issues. In2014 federated conference on computer science and information systems 2014 Sep 7 (pp. 1-8). IEEE.

16. Armbrust M, Fox A, Griffith R, Joseph AD, Katz R, Konwinski A, Lee G, Patterson D, Rabkin A, Stoica I, Zaharia M. A view of cloud computing. Communications of the ACM. 2010 Apr 1;53(4):50-8.

17. https://www.inforisktoday.com/5-essential-characteristics-cloud-computing-a4189.

18. Gong C, Liu J, Zhang Q, Chen H, Gong Z. The characteristics of cloud computing. In2010 39th International Conference on Parallel Processing Workshops 2010 Sep 13 (pp. 275-279). IEEE.

19. Dillon T, Wu C, Chang E. Cloud computing: issues and challenges. In2010 24th IEEE international conference on advanced information networking and applications 2010 Apr 20 (pp. 27-33). IEEE.

20. Bohn RB, Messina J, Liu F, Tong J, Mao J. NIST cloud computing reference architecture. In 2011 IEEE World Congress on Services 2011 Jul 4 (pp. 594-596). IEEE.

21. Wei Y, Blake MB. Service-oriented computing and cloud computing: Challenges and opportunities. IEEE Internet Computing. 2010 Nov 1;14(6):72-5.

22. Mustafa S, Nazir B, Hayat A, Madani SA. Resource management in cloud computing: Taxonomy, prospects, and challenges. Computers & Electrical Engineering. 2015 Oct 1;47:186-203.