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Availability-Aware Multi-Objective Cluster Allocation Optimization in Energy-Efficient Datacenters

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Abstract- *With increasing network virtualization, data centre's workloads are modified in depth to serve various service-oriented applications, often defined by a time-bound service response, which, in turn, places a heavy demand on data center networks. Network virtualization in computing is the technique of integrating network resources and network functions in hardware and software into one virtual network, the software-based administration entity. Number of people ask for the server simultaneously, thereby slowing down the service. It is so costly to buy a new server that we developed a virtual system by creating a virtual system. With a trend to increase the number of cloud apps in the datacenter. There are numerous physical machines (PMs) linked via switches in the datacenter. Hardware PM resources for adaptable and elastic computing capabilities are usually shared via virtualization technology. Usually a cloud application is implemented in a virtual cluster that includes many virtual machines which occupy PM resources on request.*

I. INTRODUCTION

VMs from one or more physical clusters are placed on distributed servers to form virtual clusters. The VMs inside a virtual cluster are logically linked across multi-physical networks using a virtual network. Nowadays, several types of computer systems use virtualization technologies to make full use of their own computer resources or to offer other physical machines with computing platforms.

VMs are designed to integrate several features on the same server. Since several applications are moved to the cloud, there is a huge increase in workloads at data center. When a large number of users submit requests to the same server, the service's performance suffers. So, in this system, we offer one server replica so that the primary server is not overburdened. It lowers the cost of purchasing a new server and saves energy. The burden on a single server is shared, resulting in a quicker response time for the user. A virtual cluster (VC) is used to install a cloud application, which consists of many virtual machines (VMs) that use PM resources on demand. When a result, as more applications are installed, a datacenter's energy usage increases.

5G networks are projected to use network clustering as its functional design. Within radio access networks, network operators should offer distinct user access levels (RANs). Although network clustering is mostly utilized to isolate the core network from the RAN, resource pooling may also be used. Parts of the logical network are partitioned and separated from physical resources as part of the approach.

To circumvent the aforementioned restrictions, defragmentation of bandwidth among users based on their usage is necessary in order to properly utilize bandwidth where it is truly required. User authentication is critical for security reasons, thus it will be included in the proposed technique. We'll also improve on the accuracy we've attained so far. Our major research emphasis is on optimization and placement in relation to SDN network virtualization.

II. LITERATURE REVIEW

Zhou et. al [1] in their research concentrated on VC allocation difficulties with the energy usage and VM performance. Their research adopts Zhao's energy consumption model, which is better in accordance with the current scenario, which is polynomial-fit. Zhao also builds a model for VM performance to characterize the contested PM resources like CPUs, RAMs and resource bandwidth. This paper formulates a two-target optimization issue of the VC allocation and utilizes a method for ant colony to resolve it.

Abdallah H.B et. al [2] In this document they present an effective technique for energy-efficient allotment of users to a pool of servers. The relevance of non-dominant types of resources, such as memory, generally squandered through homogenous allocation techniques, has been emphasized in this assignment model. They demonstrate that the performance of the algorithm

requires the usage of split second choices in real time situations. This method is compared to the most well-known meta heuristics used in operational research and they show that they don't improve in an acceptable amount of time.

Gamsiz M et. al [3] They examined the power-efficient management of resource in a single web- application environment with defined SLAs (response time) and application load balance. Two power- saving strategies are used: on/off computer node switching power and scaling frequency and dynamic voltage (DVFS). The basic purpose of the plan is to evaluate the expected CPU frequency obligated to give the desired reaction time, calculate the optimum range of physical nodes and establish the ratio of all nodes. The transition time to alter a node power, however, is not taken into account.

Minho Lee et. al [4] In this work they provide a transactional hypervisor to reduce the Overhead performance caused by assignment of the data cluster to the virtual disk based in qcow2. To do this, they use the current hypervisor for transactional support and propose a new file sync method, termed gsync, flushing the changed information in a bundle. In addition, they present a CoW Mechanism Optimization approach that selectively conducts CoW operations, depending on the quantity of data updated on each data cluster.

Zhiyong Ye et. al [5] In this document, authors are proposing Sova, an autonomous framework that may integrate virtual dynamic SR-IOV (DSR-IOV) with virtual machine live migration (VLM). DSR-IOV is a virtual network assignment technique based on SR-IOV, but it has a very restricted functionality on one physical machine, which in the process of calculating and communicating might lead to a local hotspot problem and probably increase service response time. VLM is, by contrast, commonly utilized to improve global network traffic through VM movement.

Xuan Liu et. al [6] In this article, researchers examine four VC and the datacenter optimization objectives, including availability, energy use, average use of resources and resource load balancing. Then we offer a multi-target optimization model and develop an algorithm of evolution between those four optimization targets. Finally, experimental results indicate our algorithm's efficiency and efficiency.

Hatem Aziza et. al [7] This paper is part of the challenge solved by cloud datacenters reducing their energy usage. In this context, we attempt to investigate a resolution using the Dynamic Voltage and Frequency Scaling (DVFS) approach, which can measure the CPU frequency, impacting energy usage. In order to demonstrate its power to fulfil the primary aim of this study, optimizing energy usage, the solution based on DVFS is contrasted with alternative approaches.

Sambit Kumar Mishra et. al [8] A generalized proposed framework built upon which service allocation issue and the energy model are defined is provided. We also give the classification of different technologies for energy efficient allocation of resources found in the research. Finally, different research issues linked to the cloud allocation of energy-efficient services are explored.

Rong Chai et. al [9] In this article developers are looking at the VNE problem at SDN, which may lead to malicious assaults on the substrate SDN switches and connections. First of all, designers suggest a multilayer SDN architecture that may be used to develop the VNE approach. Then, emphasizing the importance of network loading and of the reliability of the support network, we formulate the S DN VNE problem as a multi-target optimization problem, collaboratively minimizing the network load and maximizing integrating reliability under virtual network demand constraints and substratum network resource characteristic.

Bela Shrimali et. al [10] In this paper, researchers seek to propose a multi-objective optimization (MOO) approach to energy-efficient resources allocation. In addition, They propose and implement a strategy on the allocation of MOO-based virtual machines (VM) in CloudSim environment. The findings are compared to current policy. The results show that the energy savings of data center operations are achieved through the effective allocation of resources without affecting the performance of MOO-based policies.

III. PROPOSED SYSTEM ARCHITECTURE

Virtualization has recently become an essential element of the cloud data center. It allows service providers to share and allocate resources on request. If not using the allotted resources, VMs can be logically shrunk and consolidated. The transition to idle sleep mode can assist save energy usage. In addition, it allows cloud data centers to migrate VMs live from server to server.

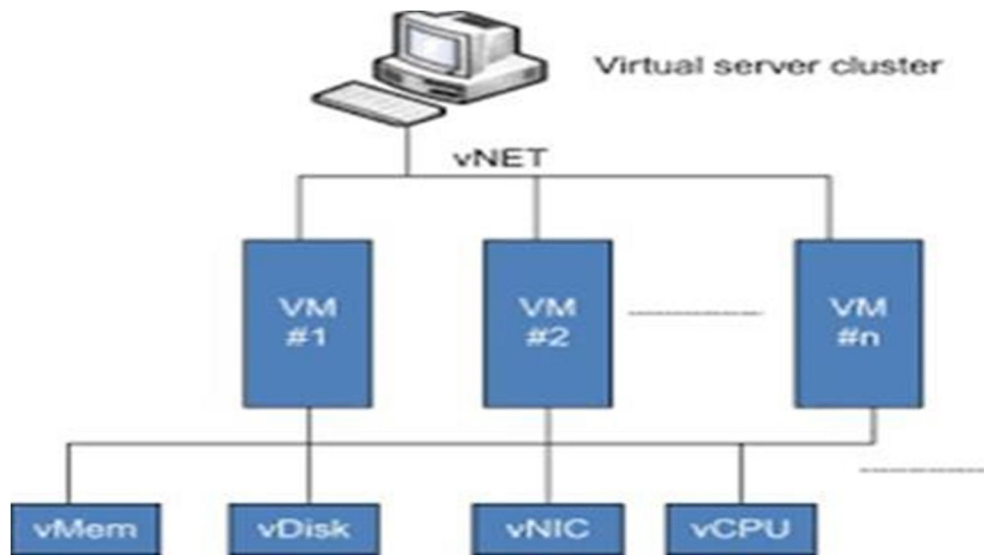


Fig. System Architecture

A. KNN Clustering Algorithm

This research establishes the K-Nearest Neighbor (KNN) method based on the above specified weights. We utilize Wab's matrix components to indicate user intervention. In row I column j of Wab, for example, the element that is $W_{ab}[i, j]$ is the interference between user I and user j. This KNN technique is proposed for users to be assigned to UDN clusters. At the pace of the clustering, the method can cluster K-users. We require N initial users if N (N - T2) clusters are needed. These users must be indicative of the original. Due to the complex calculation, N initial users are hard to get.

Algorithm

1. Find user m and n which satisfy $(m,n) = \max \{W_{ab}(I,j)\}$ 2. $V1 = \{m\}$;
 $V2 = \{n\}$
3. Delete user m and n from the user set U and $U' = U - \{m, n\}$
4. Find K users which are nearest to user m in U' , noted as $m_i, i = 1, \dots, k$.
5. Find K users which are nearest to user n in U' , noted as $n_i, i = 1, \dots, k$.
6. $V1 = V1 \cup \{m_i, i = 1, \dots, k\}$
7. $V2 = V2 \cup \{n_i, i = 1, \dots, k\}$
8. Delete user m_i and n_i from U' , $i = 1, \dots, k$.
9. Compare the elements of V1 and V2, find the mutual users for each mutual user c
10. if $\{W_{ab}(c,m) < W_{ab}(c,n)\}$, delete c from V2;
11. else delete c from V1.
12. End

Repeat: Line 4 to 12 until all the users are in clusters.

This is simple and inexpensive to comprehend. Firstly, select randomly k samples from the sample set as cluster centres: secondly, calculate the distances between all samples and k centres;

Secondly, divide the cluster into the cluster with the closest cluster center, then, calculate k new cluster centers from each cluster. The main idea for k-meters algorithm is approximately as follows. For example, cluster centers don't change or the number of iterations approaches the given value. The aforementioned procedure is iterated until a specific condition is achieved.

The k-means method is based on three premises in the simulation:

- (a) The initial two cluster centers, but the two users with the most interferences, are not randomly picked.

(b) The iteration number shall be 1.

(c) Each cluster is split into two new clusters by the input of a k-means algorithm. Therefore, the number of clusters is 2.

B. Flowchart of the system

Flow chart is used to show the actual working of system which is shows the step by step flow of our system.

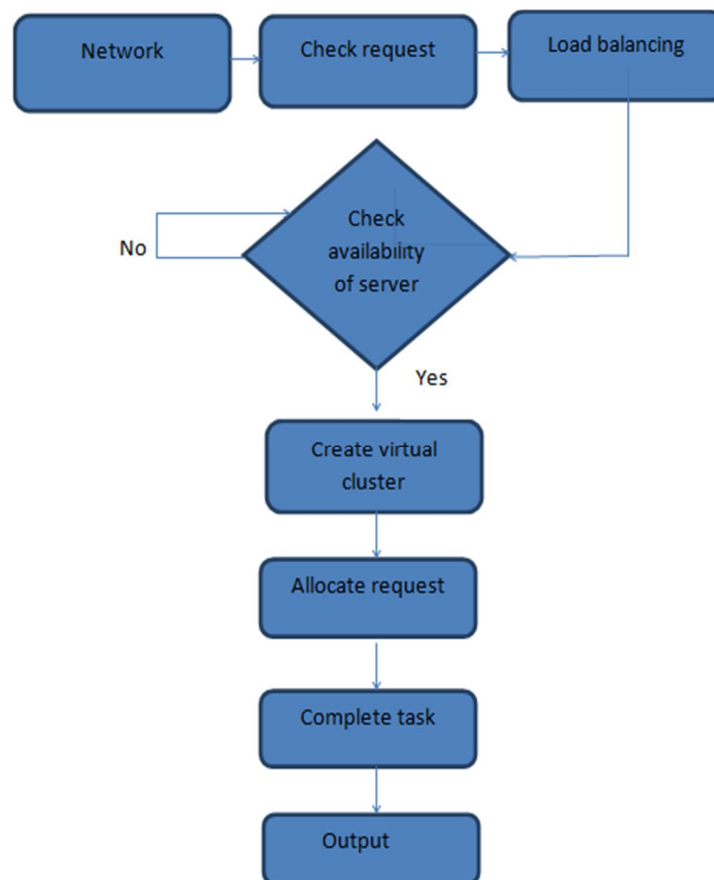


Fig. Flowchart of the system

IV. SOFTWARE AND HARDWARE REQUIRED

A. Software Requirements

1) For front-end

- a) Java
- b) Python
- c) SQLyog
- d) Net Beans 8.2

2) For Back-End

- a) MySQL
- b) Python



c) Java

B. Hardware Requirements

- a) Processor: P4 and above
- b) Hard Disk: 500 GB. (As per data)

V. RESULT

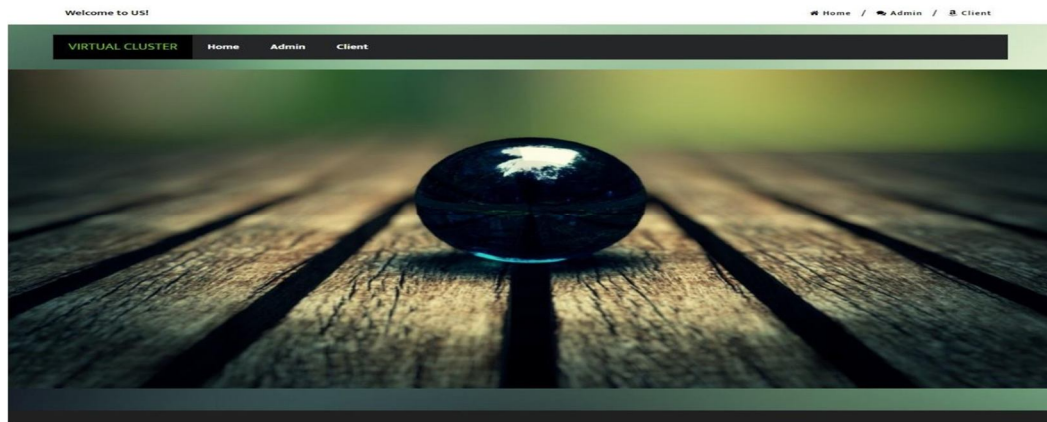


Fig. Dashboard

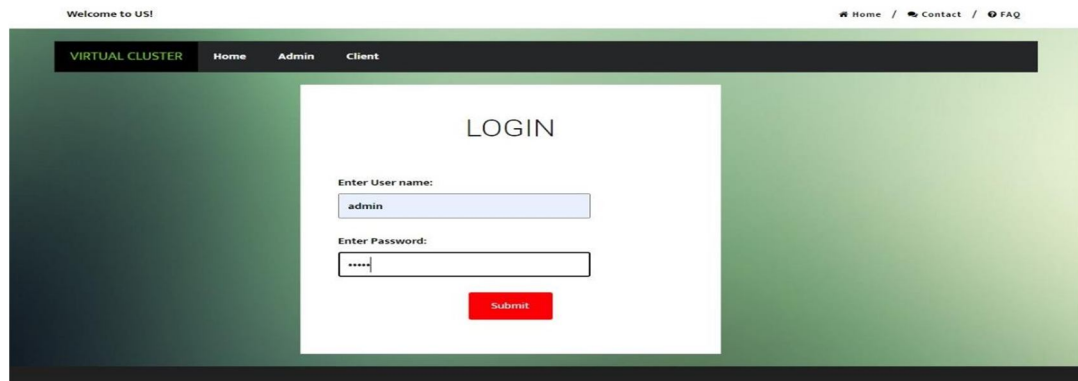


Fig. Login Page

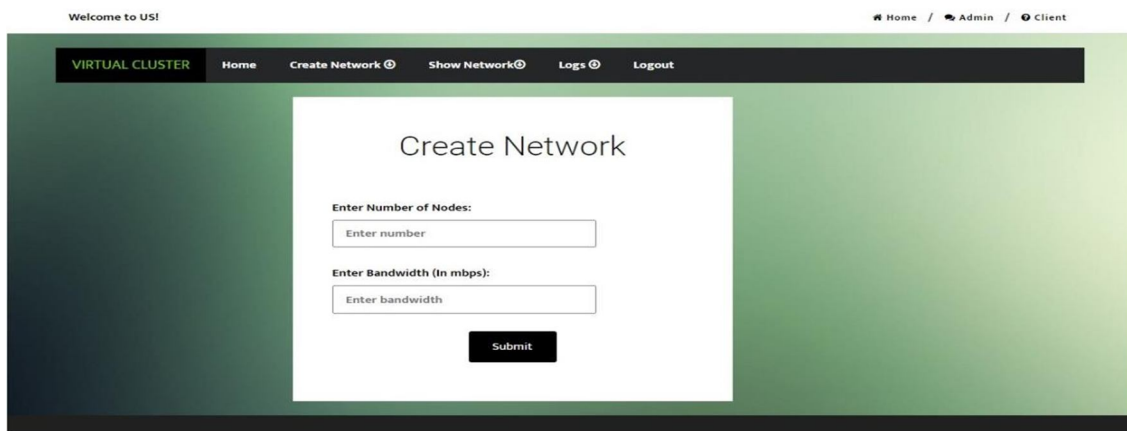


Fig. Create Network

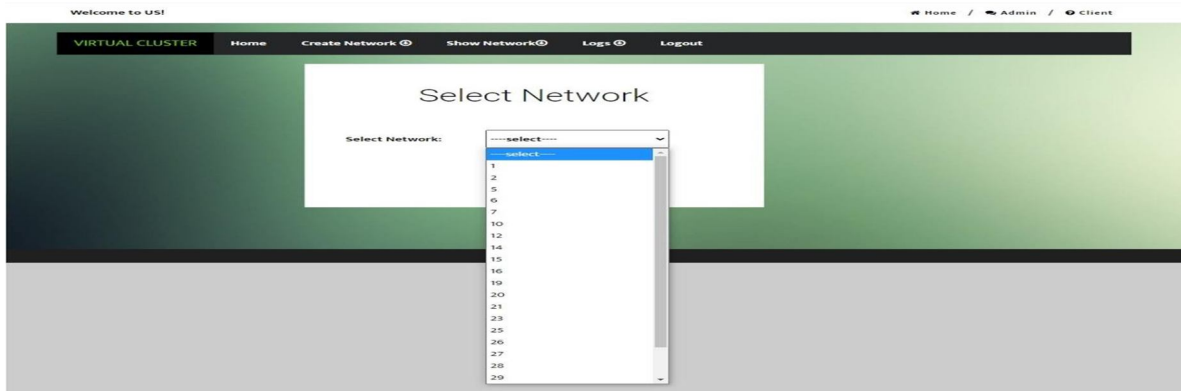
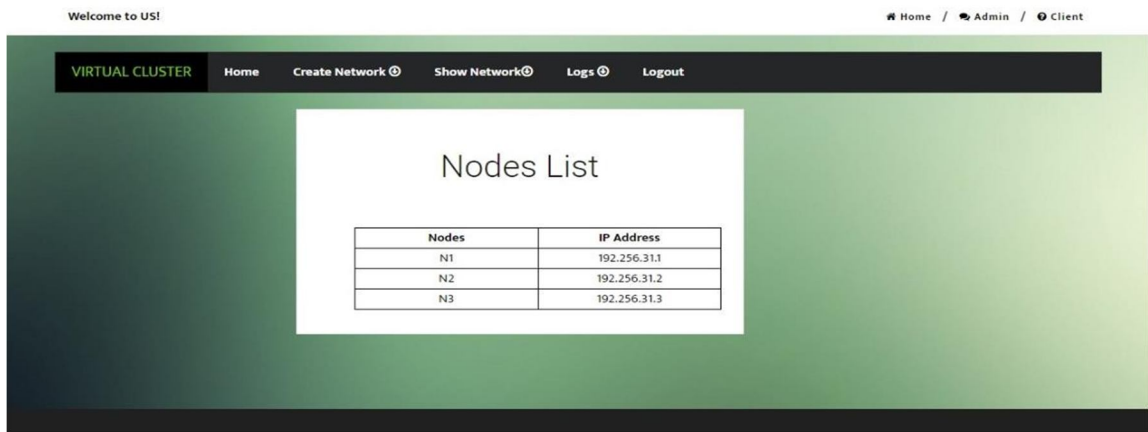


Fig. Select Network



+

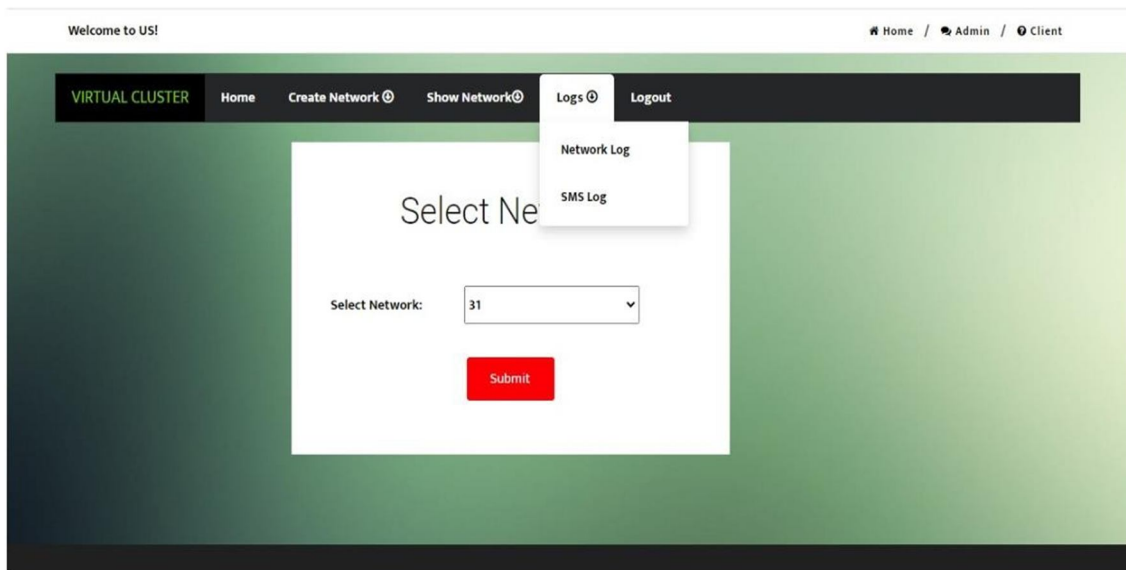


Fig. Select Node

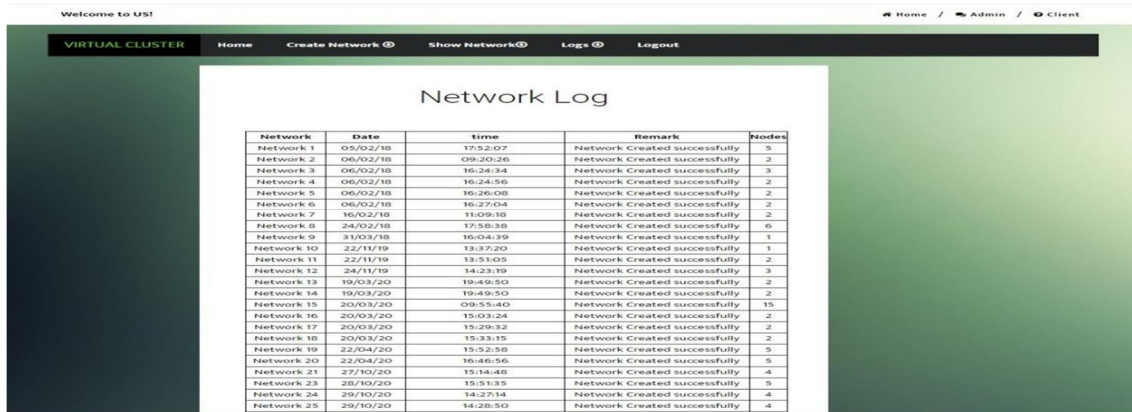


Fig. Network Log

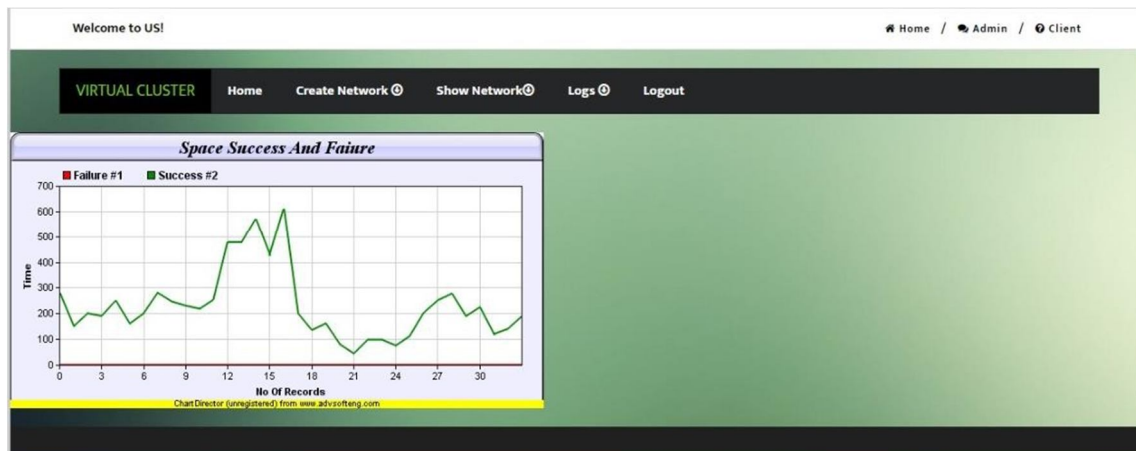


Fig. Success or failure result

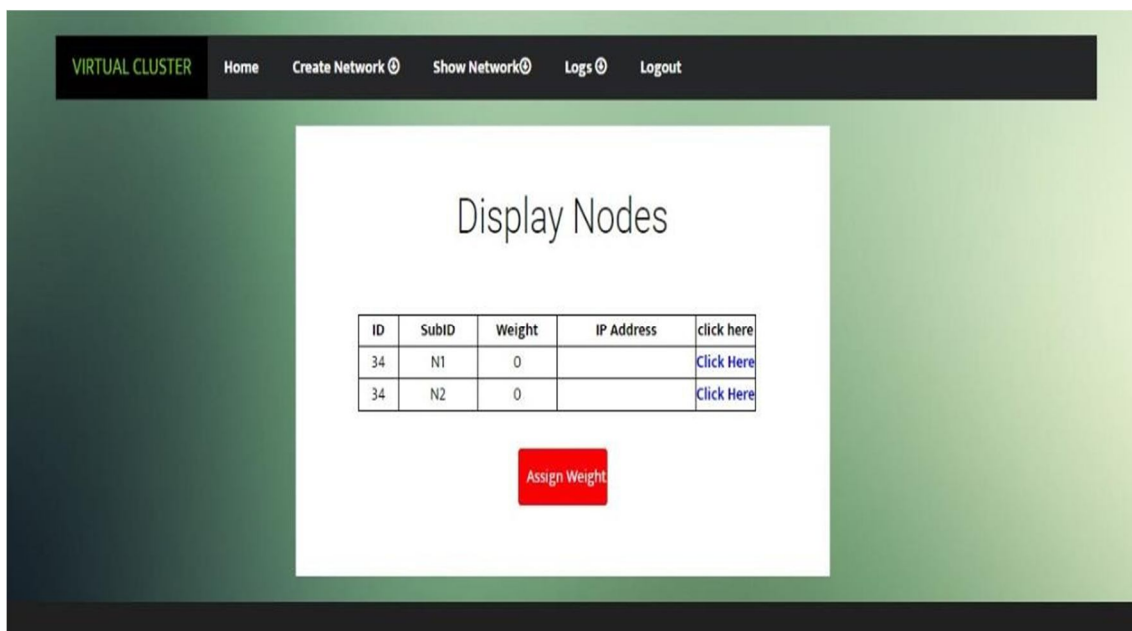


Fig. Display nodes

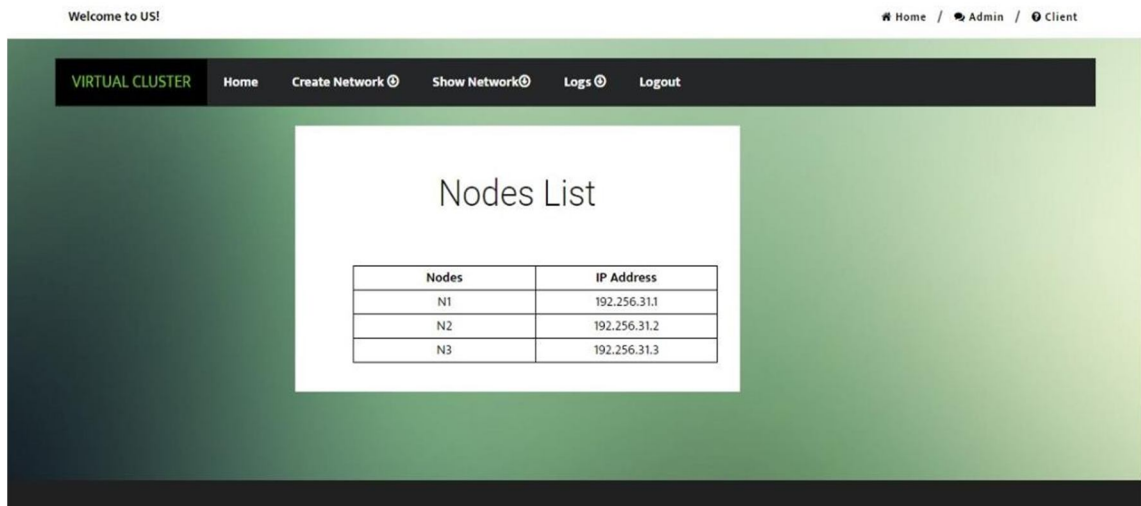


Fig. Nodes List

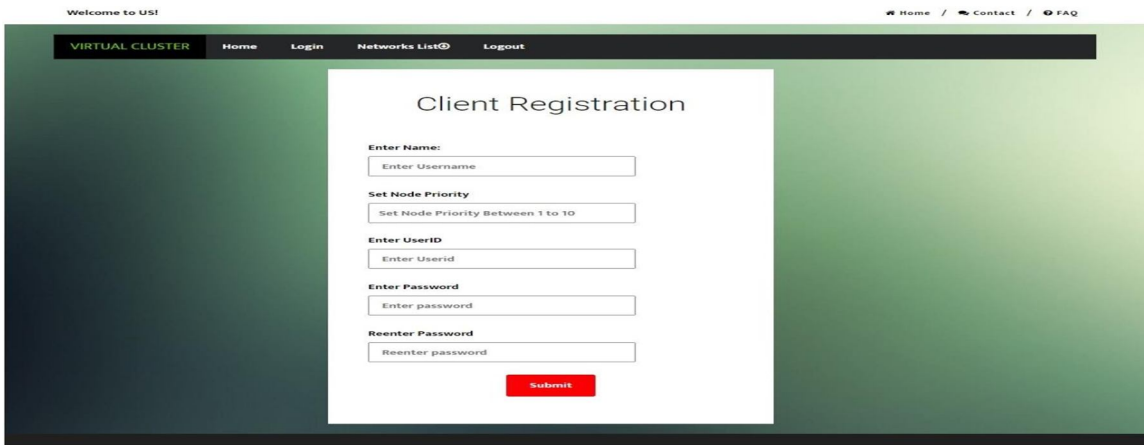


Fig. Client Registration form

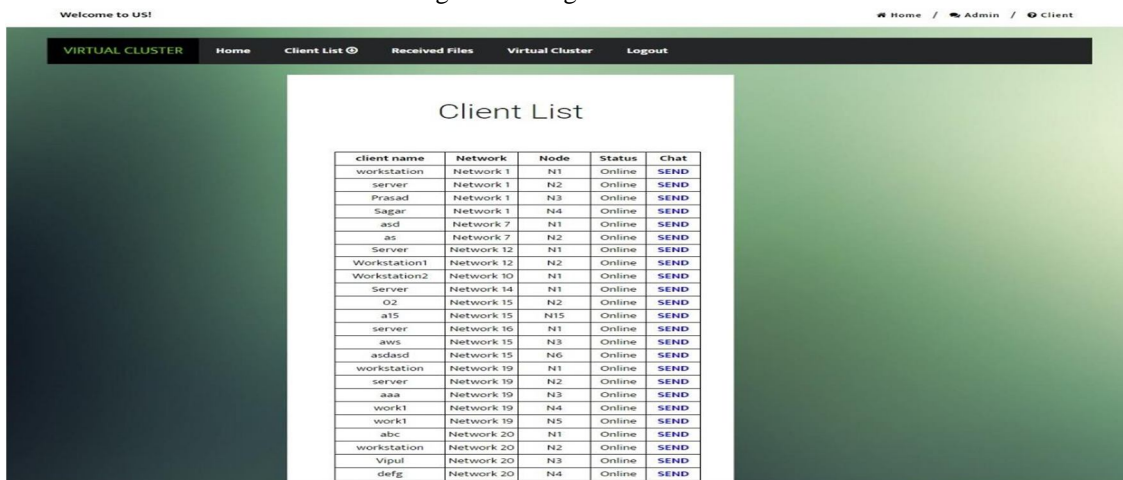


Fig. Client List



Fig. Virtual cluster created

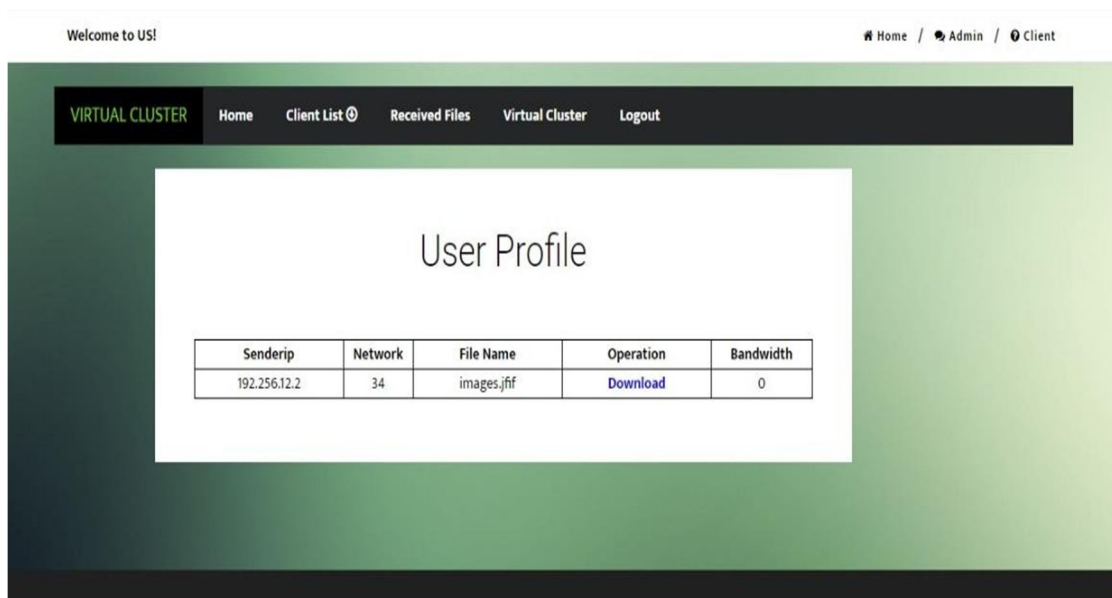


Fig. User Profile

VI. CONCLUSION

In this project, we have shown diverse energy-efficient strategies for cloud allocation. The algorithms are classified according to the input task model and the task or VM migration. In order to calculate the overall energy spent by the cloud environment, we describe an analytical cloud system model based on the model, host model, VM model and service model. In addition, we present several energy models provided by academics to quantify energy spent in the cloud system to emphasise the current research trend for the assignment of services. We believe that this paper will give a guide for future study in the growing field of energy-efficient cloud allocation. We highlight in this article the relevance of network loading and integrating network dependability. The use of VMs makes it easiest to use, easier to maintain and recover. For large-scale data it is straightforward to employ. A KNN algorithm is available. To solve a further restricted clustering problem, a KNN method has been suggested. More helpful

users with limited resources achieve energy conservation. The additional clustering problem has been targeted by a KNN method. Numerical results showed that the suggested KNN method considerably exceeds the system performance k-means clustering technique, showing better performance. On the other hand, the KNN method, with somewhat less computing complexity, has achieved a solid balance between the profit and cost from clustering and cooperative processing.

REFERENCES

- [1] Zhou, Z., Shojafar, M., Alazab, M., Abawajy, J., & Li, F. (2021). AFED-EF: An Energy- Efficient VM Allocation Algorithm for IoT Applications in a Cloud Data Center. *IEEE Transactions on Green Communications and Networking*, 5, 658-669.
- [2] Abdallah, H.B., Sanni, A.A., Thummar, K., & Halabi, T. (2021). Online Energy-efficient Resource Allocation in Cloud Computing Data Centers. *2021 24th Conference on Innovation in Clouds, Internet and Networks and Workshops (ICIN)*, 92-99.
- [3] Gamsiz, M., & Özer, A.H. (2021). An Energy-Aware Combinatorial Virtual Machine Allocation and Placement Model for Green Cloud Computing. *IEEE Access*, 9, 18625-18648.
- [4] Lee, "Designing Transactional Hypervisor for Improving the Performance of Qcow2-Based Virtual Disks", *IEEE Access*, VOLUME-8, pp[192631,192642], 2020
- [5] Tolosana-Calasan, "Sova: A Software-Defined Autonomic Framework for Virtual Network Allocations", *IEEE*, VOL. XX, pp[1-20], 2020
- [6] Shangguang Wang, "Availability-aware and Energy-efficient Virtual Cluster Allocation Based on Multi-objective Optimization in Cloud Datacenters", *IEEE*, 2020
- [7] X. Liu, B. Cheng and S. Wang, "Availability-Aware and Energy-Efficient Virtual Cluster Allocation Based on Multi-Objective Optimization in Cloud Datacenters," in *IEEE Transactions on Network and Service Management*, vol. 17, no. 2, pp. 972-985, June 2020, doi: 10.1109/TNSM.2020.2975580.
- [8] Ahmad, M.A., Patra, S.S., & Barik, R.K. (2020). Energy-Efficient Resource Scheduling in Fog Computing Using SDN Framework.
- [9] H. Aziza and S. Krichen, "Optimization of workflow scheduling in an energy-aware cloud environment," 2020 International Multi-Conference on: "Organization of Knowledge and Advanced Technologies" (OCTA), 2020, pp. 1-5, doi: 10.1109/OCTA49274.2020.9151653.
- [10] Mishra, S., Sahoo, S., Sahoo, B., & Jena, S.K. (2020). Energy-Efficient Service Allocation Techniques in Cloud: A Survey. *IETE Technical Review*, 37, 339 - 352.
- [11] Zheng Shi, "Zero-Forcing Based Downlink Virtual MIMO-NOMA Communications in IoT Networks", *IEEE*, pp[1-22], 2019
- [12] Xuan Liu, "Multi-Objective Optimization-Based Virtual Network Embedding Algorithm for Software-Defined Networking", *IEEE*, VOL-14, pp[1-14], 2018.
- [13] Bela, S. (2018). Multi Objective Optimization Oriented Policy for Performance and Energy Efficient Resource Allocation in Cloud Environment.
- [14] Rezaei, H., & Speily, O.R. (2017). Energy Aware Resource Management of Cloud Data Centers. *International Journal of Engineering, Transactions B: Applications*, 30, 1730-1739.
- [15] Mustafa, S., Bilal, K., Malik, S., & Madani, S. (2018). SLA-Aware Energy Efficient Resource Management for Cloud Environments. *IEEE Access*, 6, 15004-15020.
- [16] Polepally, V., & Chitrapati, K.S. (2018). Energy Aware GSA-Based Load Balancing Method in Cloud Computing Environment.
- [17] Kar, I., Parida, R.N., & Das, H. (2016). Energy aware scheduling using genetic algorithm in cloud data centers. *2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT)*, 3545-3550.
- [18] Madhu, B., Manjunatha, A., Chandra, P., & Chidananda Murthy, P. (2016). Minimizing Energy Consumption in Cloud Datacenters using Task Consolidation. *International journal of engineering and technology*, 8, 2188-2192.
- [19] Singh, S., Chana, I., Singh, M., & Buyya, R. (2016). SOCCER: Self-Optimization of Energy-efficient Cloud Resources. *Cluster Computing*, 19, 1787-1800.
- [20] Arroba, P., Moya, J.M., Ayala, J.L., & Buyya, R. (2015). DVFS-Aware Consolidation for Energy-Efficient Clouds. *2015 International Conference on Parallel Architecture and Compilation (PACT)*, 494-495.
- [21] Jararweh, Y., Ababneh, H., Alhammouri, M., & Tawalbeh, L. (2015). Energy Efficient Multi-Level Network Resources Management in Cloud Computing Data Centers. *J. Networks*, 10, 273-280.
- [22] Soni, S., & Tiwari, V. (2015). Energy Efficient Live Virtual Machine Provisioning at Cloud Data Centers - A Comparative Study. *International Journal of Computer Applications*, 125, 37-42.
- [23] Fayyaz, A., Khan, M.S., & Khan, S. (2015). Energy Efficient Resource Scheduling through VM Consolidation in Cloud Computing. *2015 13th International Conference on Frontiers of Information Technology (FIT)*, 65-70.
- [24] Kaur, T., & Chana, I. (2015). Energy Efficiency Techniques in Cloud Computing. *ACM Computing Surveys (CSUR)*, 48, 1 - 46.
- [25] Wu, C., Chang, R., & Chan, H. (2014). A green energy-efficient scheduling algorithm using the DVFS technique for cloud datacenters. *Future Gener. Comput. Syst.*, 37, 141-147.
- [26] Hameed, A., Khoshkbarfroush, A., Ranjan, R., Jayaraman, P., Kolodziej, J., Balaji, P., Zeadally, S., Malluhi, Q., Tziritas, N., Vishnu, A., Khan, S., & Zomaya, A.Y. (2014). A survey and taxonomy on energy efficient resource allocation techniques for cloud computing systems. *Computing*, 98, 751-774.
- [27] Sasidharan, V., & Shameem, P.M. (2013). Survey on Energy Efficient Resource Allocation Methods in Cloud Environment.
- [28] Beloglazov, A. (2013). Energy-efficient management of virtual machines in data centers for cloud computing.
- [29] Beloglazov, A., Abawajy, J., & Buyya, R. (2012). Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing. *Future Gener. Comput. Syst.*, 28, 755-768.
- [30] Yanggratoko, R., Wuhub, F., & Stadler, R. (2011). Gossip-based resource allocation for green computing in large clouds. *2011 7th International Conference on Network and Service Management*, 1-9.



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