International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol. 8, Issue.11, November 2020 E-ISSN: 2347-2693

WSN Grid Formation to Tackle Packet Drop Ratio and Increase Energy Efficiency during Packet Transmission

DazyKohli[1*], Deepak[2]

[1,2]Sri Sai College of Engineering and Technology

**Corresponding Author: dazykohli@gmail.com*

DOI: https://doi.org/10.26438/ijcse/v8i11.3339 | Available online at: www.ijcseonline.org

Received: 17/Nov/2020, Accepted: 22/Nov/2020, Published: 30/Nov/2020

Abstract- Today sensing resources are widely increased in terms of nodes and it affects the Grid computing systems. This technology is used for predicting traffic and for road safety. These systems usually share resources and collaborate with sensing devices for processing data and propagate results. In this paper we proposed WSN based delay tolerance mechanism that considers cost matrix and dynamic delay tolerance. The allocation of resources depends critically on the cost associated with virtual machine. It considers exponential residency of VC and execution time along with bandwidth utilization. Bandwidth consumption and cost of execution is reduced greatly by the effect of proposed mechanism.

Keywords- WSN, Grid computing, delay tolerance, resource scheduling

I. INTRODUCTION

Today the promising area is utilizing WSN network along with mobile Grid computing that is known as WSN Grid computing.[1] It is an integrated platform that shrinks the spectrum of services and provides data dissemination. This technology provides links between infrastructures to nodes and gives better services to the connected clients.

Grid Computing offers access to resources that are shared which includes storage space, computation power, network, applications and services on demand basis to the users over the internet. [2]The user no longer need to worry about the initial investments on the resources since Grid computing provides an approach for leveraging computing resources with same ease as utilizing common utilities such as natural gas, water , electricity supply on pay per use bases through the concept of utility oriented computing thus ensuring Quality of Service at the same time.

It gives shared services to organization along with local servers and storage resources. [3]The information can be remotely accessed from the Grid. Here everything is dependent upon Grid so all processing is done in Grid that needs commands for taking actions in network. But the network may not have enough bandwidth so it utilizes Grid computing services. In this the nodes data is uploaded over the Grid and then the information is maintained. After that according to this information that is saved in data repository over the Grid the ID for each vehicle is generated and it is saved on the Grid. This ID is further utilized for accessing the nodes and assigning the resources to the nodes.

[4] The task of overseeing networking resources turns out to be testing when utilizing diverse framework, networking advances and application that are distributed. Likewise, as disseminated frameworks increment in size and unpredictability, it winds up important to computerize a portion of the management undertakings. [5]At the point when this circumstance is contrasted and traditional management situations, it is discovered that in such frameworks manager use strategy as the reason for settling on operational management choices .Management framework where strategy server design been created for clog management. The arrangement of approaches and their principles been conveyed in the framework for overseeing and controlling the blockage in network. In this paper we proposed a WSN based delay tolerance mechanism that handles delays efficiently.

Rest of the paper is organized as under: section ii gives the literature survey, section iii gives the proposed methodology, section iv gives the result and performance analysis, section v provides conclusion, section vi gives references used in the proposed work.

II. LITERATURE SURVEY

This section gives the literature of techniques used to provide optimization within WSN Grid.

[6]The adaptive optimization of the aforementioned scheduling actions has been till now pursued by following three main parallel (e.g., disjoint) research directions, so that the proposed cognitive computing inspired joint approach seems to be somehow new. Specifically, a first research direction focuses on task scheduling algorithms for the minimization of the energy in reconfigurable data centers that serve static clients .

For this purpose, in [7], an energy-efficient greedy type scheduling algorithm is presented. It maps jobs to VMs and, then, maps VMs to Dynamic Voltage Frequency Scaling (DVFS)-enabled servers under upper bounds on the allowed per-job execution time. Interestingly, the resulting scheduler relies on a suitable version of the First-Fit-Decreasing (FFD) heuristic, in order to perform the most energy efficient VM to-server mapping and assignment of the processing rates to the servers. Its energy performance is, indeed, noticeable. However, we note that: (i) the application scenario of[8] does not consider, by design, mobile clients; and, (ii) the admission control of the input workload is not performed and the bandwidths of the intra-datacenter links are assumed fixed. Energy-efficient joint reconfiguration of the overall communication-plus-computing resources in virtualized data centers is the topic of [9], where an approach based on the stochastic nonlinear optimization is pursued. Although the resulting scheduler is adaptive and guarantees bounded per-job execution times, we point out that: (i) the application scenario of does not consider mobile clients; and, (ii) resource consolidation and admission control of the input traffic are not performed.

Energy-saving dynamic provisioning of the computing resources in virtualized green data centers is the topic of [10]. Specifically, in order to avoid the prediction of future input traffic, the authors of [11] resort to a Lyapunov-based technique that dynamically scales up/down the sizes of the VM's tasks and the corresponding processing rates by exploiting the available queue information. Although the pursued approach does not suffer from prediction errors, it relies on an inherent execution delay-vs.-utility tradeoff, that does not allow us to account for hard deadline on the execution times.

A second research direction deals with the energy efficient traffic offloading from VCs to serving RSUs by exploiting the underlying WSN-to-Infrastructure (V2I) wireless connections [11], [12].

In this framework, the focus of [13] is on the optimized task and processing rate mapping of an assigned Task Interaction Graph (TIG) to a computing graph composed by networked reconfigurable computing nodes. As in our approach, hard constraints on the overall execution times are considered by [13]. However, unlike our approach, we point out that: (i) the focus of [14] is on the traffic offloading from mobile devices to remote Grids, so that the resulting task scheduler does not support, by design, data dissemination and content delivery services; (ii) the joint task and computing rate mapping afforded in [15] is, by design, static; and, (iii) the scheduler in [16] does not perform real-time reconfiguration and/or consolidation of the computing resources hosted by the serving Grid.

The authors of [17] develop a distributed scheduler for performing mobile-to-access point traffic offloading. The scheduler enforces cooperation among the mobile devices, in order to minimize the average energy consumption of the mobile devices under per-device hard upper bounds on the volumes of the traffic to be offloaded to the remote Grid. For this purpose, in [18], it is assumed that mobile devices can execute tasks locally, offload tasks to other cooperative mobile devices or to the remote Grid, in accordance with the decision taken by the proposed scheduler. Interestingly, it exploits a Lyapunov-based optimization approach, in order to attain a good tradeoff between the average energy wasted by the mobile devices for local/remote traffic offloading and the volume of the Internet traffic generated towards the remote Grid. Thus, similarly to our work, the energy-vs.-traffic tradeoff is the focus of [13]. However, we point out that: (i) the work in [13] does not consider a mobile scenario; (ii) the scheduler in [13] does not enforce per-client QoS guarantees on the maximum execution-plus communication delay and/or the minimum processing rate; and, (iii) the energy wasted by the remote Grid for processing the offloaded traffic is not included in the objective function of [13].

A third research direction focuses on the energy consumption of hand-held wireless devices when traffic offloading over 3G/4G/WiFi connections is performed [14], [15], [16].

Specifically, [14] focuses on the CPU energy consumption of wireless devices by profiling the volume of computation that can be performed under a given energy budget. Interestingly, this paper supports the conclusion that DVFS does affect the computing energy efficiency of wireless devices, but not radically. Interestingly, it is showed in [14] that the number of performed CPU cycles mainly depends on the sizes of the tasks and the burst factors of the task streams to be processed. According to this observation, a main result of [14] is the characterization of the relationship between task sizes, average number of needed CPU cycles and burst factors of the processed task streams. Similar results are presented in [15] and [16], where analytical models for the average energy consumptions of 3G/WiFi and 4G connections are presented and tested through field trials. Overall, the contributions in [14], [15] and [16] do not afford, by design, resource management and/or scheduling optimization problems and the carried out energy analysis does not consider the effect of QoS constraints on the allowed computing-plus-communication delay.

III. PROPOSED SYSTEM

WSN based delay tolerance in Grid computing provides reliable result by reducing the congestion and assigning load to the virtual machines having least load. The starvation problem thus being eliminated using this system. The mechanism also employ cost matrix that includes cost that is being encountered when job is allotted. The architecture of the proposed mechanism is given in figure 1.

WSN BASED DELAY TOLERANCE

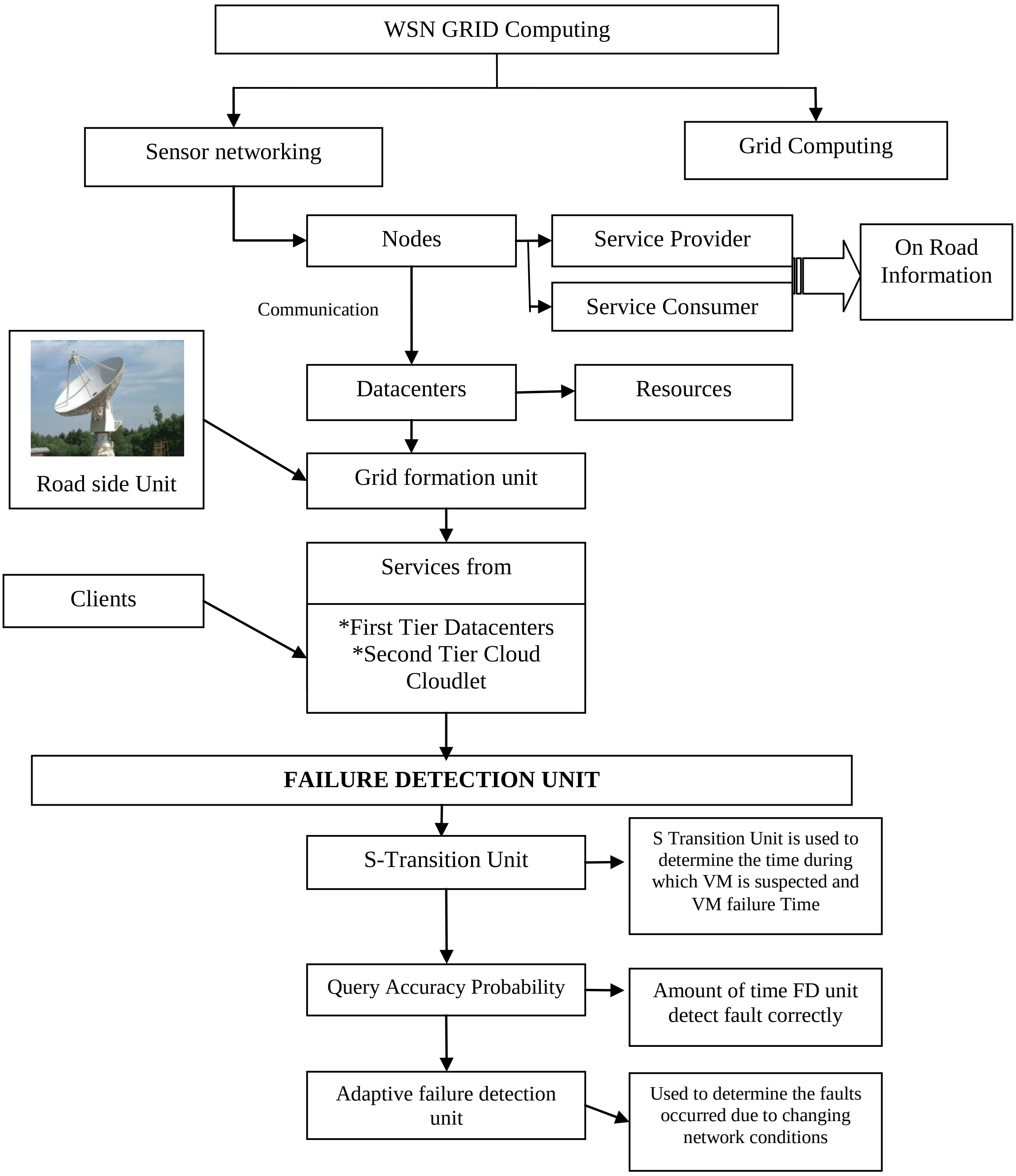

Figure 1: Architecture of the proposed system

This figure describes the structure of WSN introduction in Grid. The factors affecting the job execution in Grid using the application of WSN is given through this figure. The figure elaborate terminology and delay detection mechanism employed within the WSN based Grid.

Description of this system is presented as under

- Task Handler

Task handler is situated in Packets side which first receives the task request from the mobile device. Task handler mainly analyzes the task and makes a weight for the computational benefit from the Grid. This task handler initially assesses the whole task and the priority and importance. For the further analysis then it send to the aggregator and profile section.

- Aggregator

The aggregator mainly aggregates all the components of the task and reorganizes and rearranges it according to the sequence of the application. It basically incorporates the different components of the task and reshuffles and reorganizes the random part to make it in an orderly meaningful manner.

- Profiler

Profiler mainly responsible for analyze the applications and its different components. It describes the need of demand for computation units need to complete the task execution. In addition it can make the all components of profile to identify and reorder the task and calculate the whole necessary resources needed to finish the work.

- Analyzer and Optimizer

After profiling, tasks are handed to the analyzer and optimizer section for further analysis based on the profiler data. By using optimization techniques, analyzer and optimizer decide to further processing of the request tasks which should be optimally done by the available resources for the Packets and mobile devices.

- Scheduler

Scheduler makes the scheduling for complete the task. It assigns the priority which devices the task will reschedule and overall available resources for task scheduling. When task finish then it update accordingly and make the resource free for the other sequential important task for completion.

- Partition/Decision Engine

The decision engine makes the decision of application execution. It could be the in to Packets or to the mobile devices other than the sending devices. This section makes decision after analysing the resources associated with the mobile devices resources. We employ several decision making algorithm in this stage to get the optimized and enhanced performance by make the decision that should be the optimized one.

- Mobility Manager

Mobility manager hold the status of all the mobile devices connected to the Packets in the proximity of Packets. It can be done by storing all the Wi-Fi signal strength registered with the Wi-Fi zone and their signal strength confirm us the proximity of the all the nearest devices. Among them, from the client profiler, we can have the resources latest update and the information who are waiting for the Packets services by the receiving the results from the Packets. Mobility is an important aspect which we also consider in our framework. From the mobility pattern analysis, when decision engine make decision which mobile device, it is going to offloaded task to the client devices can help the predicted mobile device.

- Resource Manager

Resources indexing are keeping as a database to the Packets. All the available and presently used resources are keep track by the resource manager. Therefore resource manager is responsible for keep all the updated data and information in the Packets which is very important for the decision engine to estimate the available resources from the Packets. Hence, every new device joining in the network should register their resources by the profiler to the Packets and again, when any device leave the network, instantly the resource manager remove the device and it's available resources from the database.

- Migrator

Packets use Migrator to transfer the portion of data or code segment or process to migrate to the surrounded mobile devices. Obviously, decision engine using our algorithms make decision to choose the best case mobile device. After that for sending the code, migrator is responsible of sending to the mobile device. Migrator receives the result from the mobile device to process it again by sending to the aggregator and other further steps.

- Client Devices Resources

The resources which are embedded with the client mobile devices are mentioned or marked here as user device resources. It could be CPU, memory or even storage. Several cases it could be the installed software that cannot be processed by the Packets or clod let has not installed with the software facility. We can have huge sensors now a day that could be great resources as well such as GPS, camera, thermometer, location apps, and embedded other latest sensors.

- Packets Resources

Resources which are belongs to Packets are normally considered as CPU, memory, and hard disks. In this experiment and our frame work, mainly we consider the compute-intensive applications, hence we identified the CPU is the main resources. As, we proof in chapter 1 that certain cases, this resources are not adequate and we call it some point it as a resource scarcity which degrade the overall Packets performance negatively. We aim to consider the problem and propose the solution to shift some application or process from the Packets to the nearest mobile devices that they can act as collaborative resources for the Packets. Since when the loads are reduced from the Packets, ultimately the performance has been increased and the results we get from the nearest mobile devices as working as a resource node or hub eventually make the whole process faster and make the Packets to increase the performance and can get rid of resource scarcity.

The flow of proposed system is given in figure 2

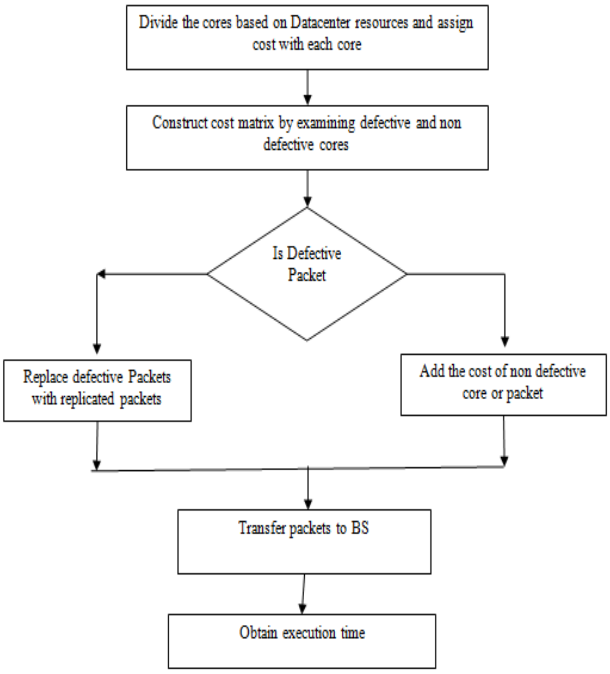

Figure 2: Flow of proposed system

The delay tolerance unit is the main objective of this literature. This unit detects the delays from the core and performs the migration. The migration performed through this system decrease the overall cost associated with the transmission.

IV. RESULTS AND DISCUSSION

The result obtained from the proposed system shows optimization. The result obtained interms of distinct parameters. The parameters used in the proposed system includes average cost, execution time and delay tolerance rate.
The cost encountered in terms of overhead is presented through Table below :

	Without Cost Matrix	Base Paper	Proposed Work
100 Packets	4.3	4.1	3.2
200 Packets	5.5	5.4	4.9
300 Packets	6.3	6.1	5.3
400 Packets	7.5	6.8	6.5

$$Cost = BS\_cost * Total\ cloudlets\ executed$$

The cost encountered in terms of overhead is presented through figure 9

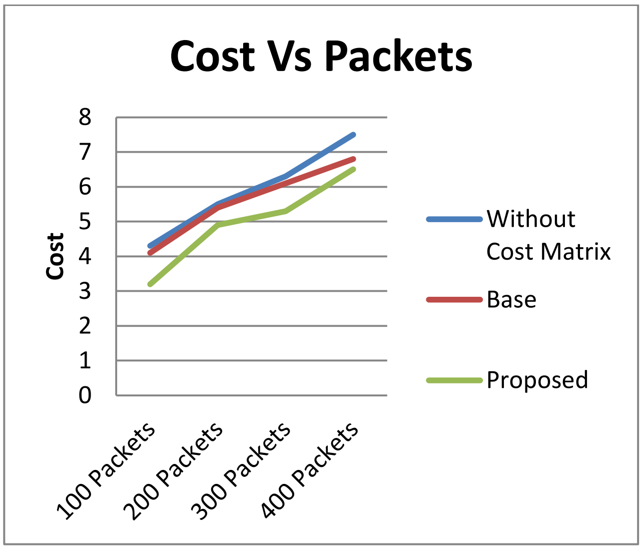

Figure 9: Cost Comparison with existing and proposed system.

The cost or overhead increases as number of Packets increases. The cost matrix used shows deviation and falls very close to static allocation mechanism at least load. The load when increases cost vary exponentially. The execution time indicating difference between start and end time. The table below shows the comparison between execution time

$$Execution\ time = finish\_time - Start\_time$$

	Without cost matrix	With Cost matrix	With Cost matrix and dynamic load
100 Packets	15.2	14.5	10.9
200 Packets	16.7	14.9	11.5
300 Packets	18.2	15.3	12.1
400 Packets	19.7	15.7	12.7

The execution time comparison is shown with the help of figure 10.

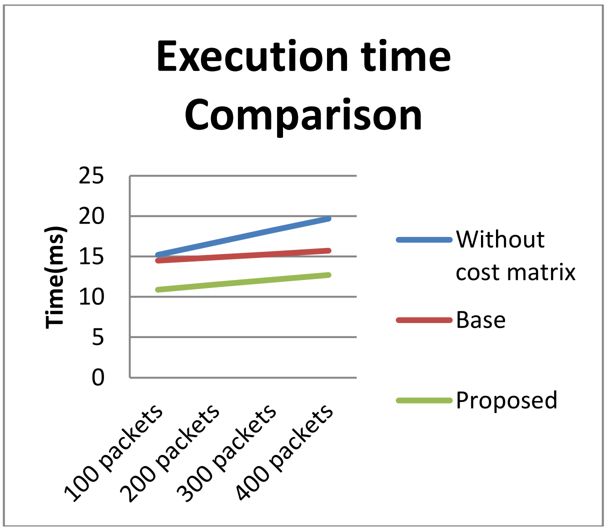

Figure 10: Execution time comparison

The execution time decreases as the machine selected for load allocation is optimal. The load decreases with the application of proposed system. The execution time is estimated using the standard command system. current time in (millis) of MATLAB.

The delay tolerance rate increases as the optimal virtual machine is selected for load allocation. The load allocation and delay tolerance rate is given through the figure 11

$$Fault\ tolerance\ rate = no.\_of\_faults\ /\ Execution\_time$$

	without cost matrix	Base	Proposed
100 Packets	0.3	0.4	0.5
200 Packets	0.29	0.38	0.498
300 Packets	0.26	0.37	0.47
400 Packets	0.24	0.3533333	0.46

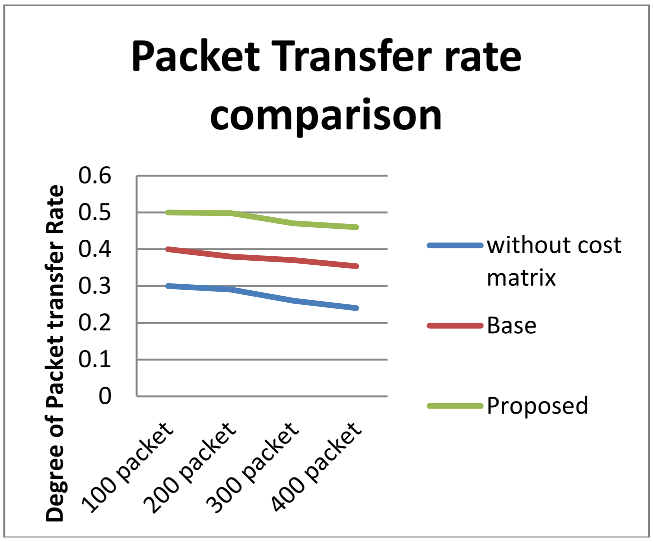

Figure 11: Degree of delay tolerance or packet transfer rate

The degree of delay tolerance is the criteria through which worth of study can be checked. The delay tolerance rate is significantly higher in case of proposed system as compare to existing approaches. The dynamic load variation is the primary cause of improvement of delay tolerance rate. The static cost matrix mechanism also shows improvement however since same machine is selected again and again hence congestion causes the problem. Dynamic cost matrix formation however improves the overall parametric results.

MTTF (mean time to transfer)
It is the basic unit of measuring reliability of system. The total time used by an item during start of execution till its transfer is known as MTTF. In the other words it represents the lifetime of a system. In the proposed system mean time to transfer increased and the reliability of system enhanced significantly as compared to existing system. The figure below shows the MTTF of proposed and existing system

$$MTTF = total\ hours\ of\ time\ /\ total\ number\ of\ units$$

	without cost matrix	Base	proposed
100 Packets	0.56	0.54	0.66
200 Packets	0.63	0.697	0.72
300 Packets	0.624	0.68	0.76
400 Packets	0.73	0.75	0.86

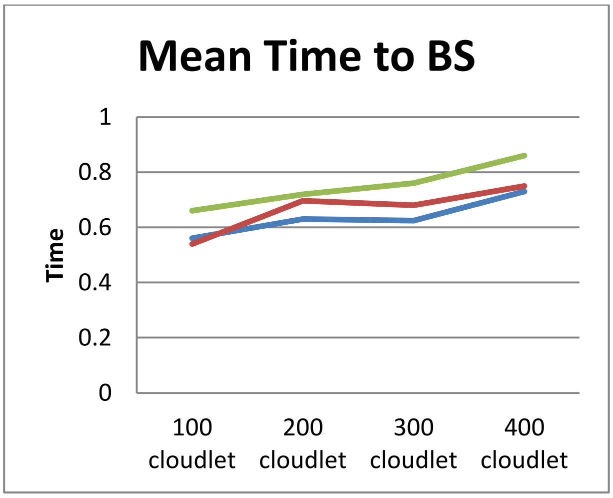

Figure 12: Mean time to Transfer

V. CONCLUSION

The WSN Grid used for delay tolerance provides new methodology for improving performance of Grid. Virtual machines are mobile in this case. The load allocation considers the cost associated with the virtual machine. This cost varies as the virtual machines shows deviation in terms of load. The virtual machine is discarded from cost matrix having higher load. This can cause steep hike in cost but congestion decreases. Thus parametric comparison shows improvement and Packets are executed with greater rates as compared to existing system.

Future Scope
Further it must be enhanced in the field of IOT to conserve the energy of sensor network. In future the WSN Grid based framework can be designed for intelligent transport system.

REFERENCES

[1] R. K. Naha, S. Garg, D. Georgakopoulos, P. P. Jayaraman, L. Gao, Y. Xiang, and R. Ranjan, "Fog computing: Survey of trends, architectures, requirements, and research directions," *IEEE Access*, **vol. 6, no. c, pp. 47980–48009, 2018.**

[2] B. Brik, N. Lagraa, N. Tamani, and A. Lakas, "Renting out Grid Services in Mobile WSN," *Res. Gate*, no. **December, 2018.**

[3] M. R. Jabbarpour, A. Marefat, A. Jalooli, and H. Zarrabi, "Correction to : Grid-based WSN networks : a taxonomy , survey , and conceptual hybrid architecture Could-based WSN networks : a taxonomy , survey , and conceptual hybrid architecture," *Wirel. Networks*, no. **November, 2017.**

[4] R. Yu, X. Huang, J. Kang, J. Ding, S. Maharjan, S. Gjessing, and Y. Zhang, "Cooperative resource management in Grid-enabled WSN networks," *IEEE Trans. Ind. Electron.*, **vol. 62, no. 12, pp. 7938–7951, 2015.**

[5] T. Mori, Y. Utsunomiya, X. Tian, and T. Okuda, "Queueing theoretic approach to job assignment strategy considering various inter-Arrival of job in fog computing," *19th Asia-Pacific Netw. Oper. Manag. Symp. Manag. a World Things, APNOMS 2017*, **pp. 151–156, 2017.**

[6] K. Zheng, H. Meng, P. Chatzimisios, L. Lei, and X. Shen, "An SMDP-Based Resource Allocation in WSN Grid Computing Systems," *IEEE Trans. Ind. Electron.*, **vol. 62, no. 12, pp. 7920–7928, 2015.**

[7] K. Zhang, Y. Mao, S. Leng, Q. Zhao, L. Li, and X. Peng, "Energy-efficient Offloading for Mobile Edge Computing in 5G Heterogeneous Networks," *IEEE Access*, **vol. 3536, no. c, pp. 1–10, 2016.**

[8] W. Zhang, Z. Zhang, and H. Chao, "Cooperative Fog Computing for Dealing with Big Data in the Internet of Nodes : Architecture and Hierarchical Resource Management," *IEEE Access*, no. December, **pp. 60–67, 2017.**

[9] J. Fan, R. Li, and X. Zhang, "Research on delay tolerance strategy based on two level checkpoint server in autonomous WSN Grid," *Proc. 2017 IEEE 7th Int. Conf. Electron. Inf. Emerg. Commun. ICEIEC 2017*, no. 61363079, **pp. 381–384, 2017.**

[10] Y. Sharma, B. Javadi, W. Si, and D. Sun, "Reliability and energy efficiency in Grid computing systems: Survey and taxonomy," *J. Netw. Comput. Appl.*, **vol. 74, pp. 66–85, 2016.**

[11] H. S. Y. Lin, "EAFR: An Energy-Efficient Adaptive File Replication System in Data-Intensive Clusters," *IEEE Trans. Parallel Distrib. Syst.*, **pp. 1017–1030, 2017.**

[12] B. Shrimali and H. Patel, "Performance Based Energy Efficient Techniques For VM Allocation In Grid Environment," *IEEE Access*, **pp. 477–486, 2017.**

[13] H. . Z. D. . Zhao B.a Aydin, "Reliability-Aware dynamic voltage scaling for energy-constrained real-time embedded systems," *26th IEEE Int. Conf. Comput. Des. 2008, ICCD*, **vol. 546244, pp. 633–639, 2008.**

[14] H. M.-R. Mahdi Ghamkhari, "Energy and Performance Management of Green Data Centers: A Profit Maximization Approach," *IEEE Trans. Smart Grid*, **pp. 1017–1025, 2017.**

[15] M. Salehi, M. K. Tavana, S. Rehman, S. Member, M. Shafique, and A. Ejlali, "Two-State Checkpointing for Energy-Efficient Delay Tolerance in Hard Real-Time Systems," **pp. 1–12, 2016.**

[16] S. Ben Alla and A. Ezzati, "Hierarchical adaptive balanced energy efficient routing protocol (HABRP) for heterogeneous wireless sensor networks," *Ieee*, **2011.**

[17] P. Handa, B. Singh Sohi, and N. Kumar, "Energy efficient hybrid routing protocol for underwater acoustic sensor network," *2016 Int. Conf. Electr. Electron. Optim. Tech.*, **pp. 2573–2578, 2016.**

[18] B. Mills, T. Znati, R. Melhem, K. B. Ferreira, and R. E. Grant, "Energy consumption of resilience mechanisms in large scale systems," *Proc. - 2014 22nd Euromicro Int. Conf. Parallel, Distrib. Network-Based Process. PDP 2014*, **pp. 528–535, 2014.**

AUTHORS PROFILE

Dazy kohli pursued Bachelor of Technology in Computer Science and Engineering from Model Institute of Engineering and Technology University of Jammu, J&K .Currently, pursuing Master's of Technology in Computer Science and Engineering from Sri Sai College of Enginering &Technology,Badhani,Pathankot.
Her research interest is Big Data, Data Analytics and Data Mining.

Deepak Kumar has done his B.E in Computer Science and Engineering from DAVIET,Jalandhar Mtech in Computer Science and Engineering from Beant College of Engineering and Technology,Gurdaspur.
His area of interest is Big Data,Cloud Computing