International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 05 | May-2016 www.irjet.net p-ISSN: 2395-0072

Mobility Based Fault Recovery Using Replication Approach in Mobile Grid Environment

Gurpreet Kaur

M.tech Research scholar

Department of Computer Science Engg., Sri Guru Granth Sahib World University,

Fatehgarh Sahib, Punjab, India

Abstract- *Mobile grid is a type of distributed systems that utilizes the sharing of resources to achieve better computational results. Loss of network connectivity is often frequent in mobile grid because of mobile nature of its devices. The performance of distributed system gets degraded when fault occurred due to mobility of nodes in the system. This paper proposes a scheme for efficient job scheduling using replication approach to improve fault tolerance of mobile grid. The proposed approach reports less packet overhead, energy consumption and delay as compared to existing real time task scheduling scheme.*

Keywords- Mobile grid, Fault tolerance, Task scheduling, Task Replication, Candidate node.

1. INTRODUCTION

Computing system is a system that involves many computers and associated software with a common storage. There are two types of computing policies comes under computing system i.e. distributed computing and parallel computing. A distributed system is a combination of resources or devices which are geographically distributed and heterogeneous in nature. In distributed computing each processor has its own private memory and communication is done by passing messages between processors.

Parallel computing is another type of computing that handles simultaneous execution of tasks. Distributed systems are divided into several categories such as cloud computing and Grid computing. Cloud computing is an environment that provides scalable and inexpensive on demand computing network access to users with minimal management efforts. Grid computing is one of most important techniques in high throughput computing era. In other words, Grid computing is a type of distributed system that combines heterogeneous geographically distributed resources to solve large scale problems. Grid systems don not support sharing of only documents but also resources like hardware and software. The increasingly demand of wireless devices such as laptops, PDA, and smart phones lead to development of new computing era known as wireless grid computing. The factor that distinguishes mobile grids from grid computing is the mobility of devices. Due to mobile nature of wireless grid computing devices, a number of challenges are faced by the users such as loss of connectivity, job scheduling, resource management, security and fault tolerance etc. In order to deal with above said challenges, various approaches are used in wireless grid environment. In order to effectively utilize the resources and to improve the overall system performance, certain fault tolerant implementations are must.

2. RELATED WORK

Abhishek Bichhawat and R. C. Joshi [2] have defined distributed systems as homogeneous and heterogeneous systems that achieve high performance instead of facing different type of issues such as fault tolerance, security and Qos etc. Shilpa Gambhir and Er. Sonia Goyal [9] have presented a load balancing algorithm in order to improve the efficiency of distributed systems. The proposed algorithm is capable of distributing the load equally among mobile nodes which reduces the chance of fault occurrence and also reduces the Task execution time that leads to improvement in network efficiency. Hazem Morsy and Hesham El Rewini [1] have overcome the mobility challenges of point to point communication between the task initiator and service provider by introducing an

adaptive scheduler. The proposed scheduler deals with real time application tasks and includes two heuristics to solve the problem of mobility. In the first approach, scheduler uses maximum flow algorithm in which maximum number of tasks are selected to be executed before their deadline by taking into account resource's mobility. In the second approach, scheduler attempts to schedule the tasks based on resource availability, mobility and power consumption. Sajjad Haider et.al [10] has presented the various failures and faults tolerance techniques used in the distributed systems. They also provided a comparison of various fault detection and fault tolerant techniques used in the distributed systems. Yuan Xue and K. Nahrstedt [8] have proposed an end to end fault tolerance algorithm to achieve high packet delivery rate in mobile ad hoc network. The proposed algorithm uses two policies; route estimation and route selection. The route estimation policy gives improved estimation results via iterations and the route selection policy uses these estimation results in order to select multipath route for packet delivery. The work given in [5] addresses the problem of fault tolerance and recovery of failed mobile nodes using mobility based on check pointing and trust based rollback recovery algorithm. The proposed technique uses a concept of 'cluster-change-count' which is incremented by 1, when a mobile host leaves a cluster and joins another cluster. The check pointing is stored in the cluster head. In this work, the recovery to the failed node is provided by forwarding the check pointing through the trusted nodes. S. Stephen Vaithiya and S. Mary Saira Bhanu [6] have proposed a task scheduling algorithm to achieve the effective and efficient utilization of mobile resources in mobile grid. The proposed algorithm predict the resource availability based on movement type, movement pattern and movement direction of resources within the zone. The work done in this paper achieves better results because the run time parameters of resources in the system are considered prior to their execution. Raman deep Kaur et.al [13] have proposed a new approach of using antecedence graphs in order to maintain fault tolerance and message logs information. Here only dependent variables use antecedence graphs to save check pointing.

3. PROPOSED TECHNIQUE

In proposed technique, a replication approach is used under which each task is replicated to all candidate nodes in mobile ad hoc grid. The task is replicated to nodes that satisfy the job requirements in terms of resources. The nodes that meets the require resources are chosen as candidate nodes and then these candidate nodes are provided with replicas of task by master node.

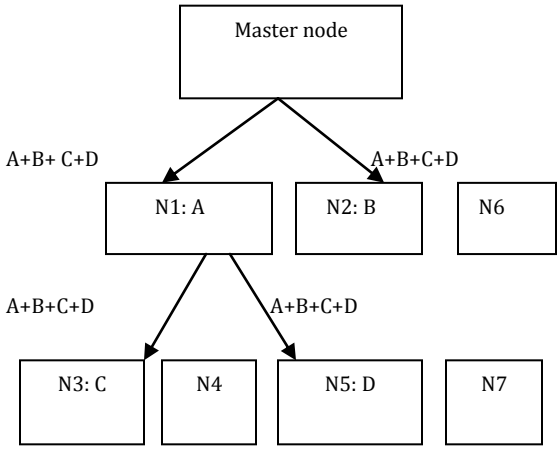

Fig -1: Proposed task Allocation Method

Fig-1 shows the mobile ad hoc grid system with one master node and 7 sub nodes. From these sub nodes, only four nodes are selected as candidate nodes i.e. node 1, 2, 3 and 5 respectively. Now
master node replicates sub parts of task to all these candidate nodes with an instruction that a particular node will execute a specific part of task. Here all the four candidate nodes have complete sub-parts of task 'A+B+C+D'. Candidate nodes start execution to specific sub part of task according to given instruction. Master node check the connectivity and execution status of candidate nodes using ping messages and waits for 5 sec to get acknowledgement. If any candidate node do not replies within that fixed time slice, then that node is detected as faulty node. As per given instruction, nodes 1, 2, 3 and 5 has to execute A, B, C, D tasks accordingly. Now suppose node 5 leaves the network due to unpredictable mobility behavior that causes to interrupt the execution of task D. The fault due to node mobility is detected by master node as node 5 has not replied to the ping message. Now master node searches a new candidate node that has completed more than half execution. The node that satisfy the master node requirements revert back with its identification. Now suppose node 3 has finished more than half execution and it replies back to master node. Then master node gives an instruction to node 3 to execute the task of failed node. By doing so it takes less time to reallocate its task to new nodes because all the tasks are stored in their queues and also has similar resources which help to improve fault tolerance through recovery.

4. RESULTS & COMPARISON

The proposed method has been implemented in NS2 and the performance of proposed technique is analyzed by using three parameters that are energy consumption, delay and packet overhead.

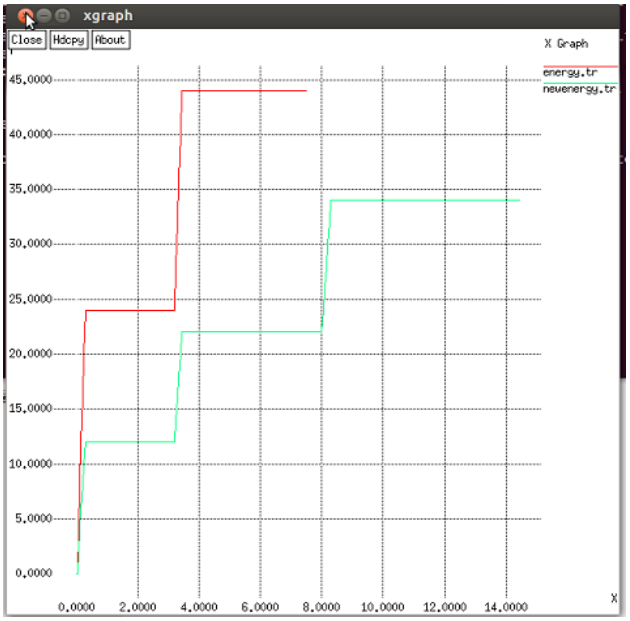

Chart -1: Energy Consumption

Chart-1 shows the comparison of energy consumed by system to effectively allocate tasks in case of failure. Existing approach consumes more energy as compared to new approach. Under new approach complete task is executed in small amount of time, so few a joule of energy is consumed by the proposed approach.

As illustrated in Chart-2, more number of tasks are performed under enhanced approach as compared to existing approach. As time consumed for execution of whole task is less, so delay is minimized in the presented approach. The new approach helps in minimizing the task execution time thus the performance of application is increased.

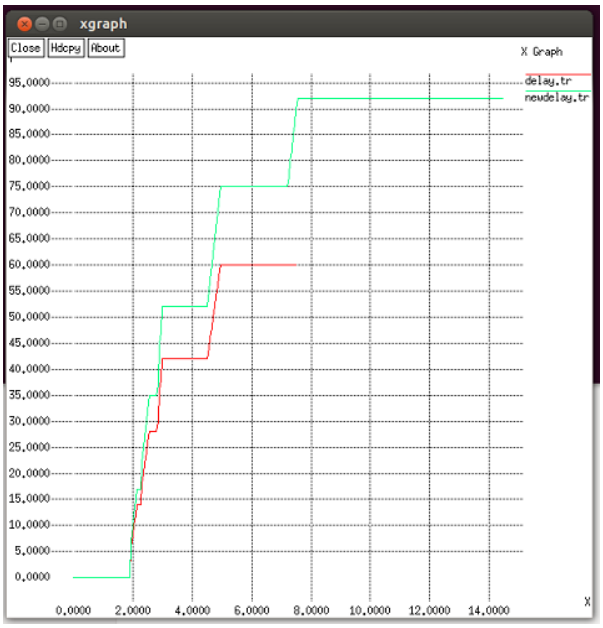

Chart -2: Delay

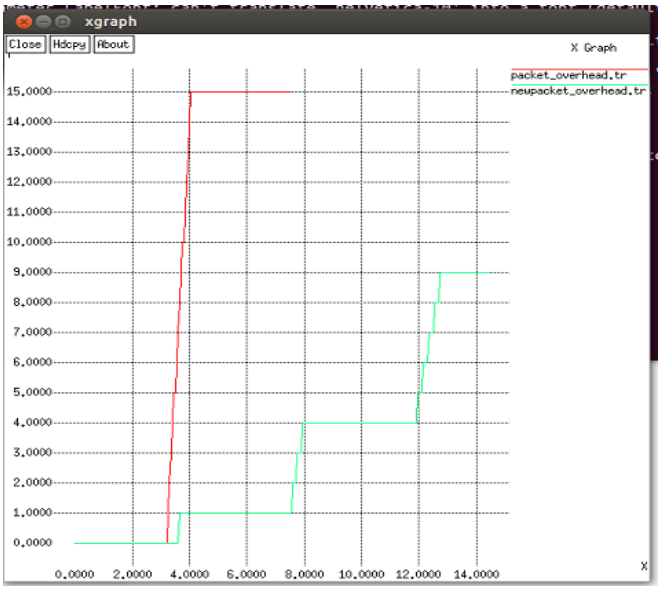

Chart -3: Packet overhead

As the fault is detected and recovered within small amount of time so less packet overhead is achieved in new approach as compared to existing one which is presented in figure 4.

5. CONCLUSION & FUTURE SCOPE

Due to mobile nature of wireless devices, a number of unique challenges are being faced by users in wireless grid. Various approaches have been surveyed to resolve these challenges in this paper. Adaptive task scheduling and replication techniques are used to recover from fault during job execution. The fault due to node mobility is detected using ping messages within fixed time slice. The new approach helps to execute the complete task in minimum time thus the overall system performance is increased. The results are far better than existing method. Experimental results show the system reliability in terms of less execution time, energy consumption and packet overhead. The proposed work can be extended to include check pointing to further improve the task execution time.

REFERENCES

[1] Hazem Morsy and Hesham El-Rewini, "Adaptive Scheduling in a Mobile Ad-Hoc Grid for Time-Sensitive Computing", IEEE 2013.

[2] Abhishek Bichhawat and R. C. Joshi, "A Survey on Issues in Mobile Grid Computing" Int. J. of Recent Trends in Engineering and Technology, Vol. 4, No. 2, Nov 2010.

[3] R. C. Joshi and Abhishek Bichhawat , "Proactive Fault Tolerance Technique for a Mobile Grid Environment", International conference on advances in computing and communication, 2011.

[4] D.Maheshwari "Fault Tolerance in Mobile ad hoc Network: A Survey", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, Issue 3, March 2013.

[5] Suparna Biswas, "Mobility Based Checkpointing and Trust Based Recovery in Manet", International Journal of Wireless & Mobile Networks (IJWMN), Vol. 4, No. 4, August 2012

[6] S. Stephen Vaithiya and S. Mary Saira Bhanu,"Zone Based Job Scheduling in Mobile Grid Environment", International Journal of Grid Computing & Applications (IJGCA), Vol.3, No.2, June 2012.

[7] Ruchi Tuli and Parveen Kumar, "Asynchronous Check pointing and Optimistic Message Logging for Mobile Ad Hoc Networks", (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 10, 2011.

[8] Yuan Xue and K. Nahrstedt, "Fault tolerant routing in mobile ad hoc networks", IEEE Conference on Wireless Communications and Networking, Vol.2, Page(s): 1174 – 1179, March 2003.

[9] Shilpa Gambhir and Er. Sonia Goyal, "Fault Tolerance and Task Allocation in Distributed Mobile Computing System", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Vol. 3, Issue 6, June 2014.

[10] Sajjad Haider et.al, "Fault Tolerance in Distributed Paradigms", International Conference on Computer Communication and Management Proc .of CSIT , IACSIT Press, Singapore, vol.5, 2011.

[11] Sanjay P. Ahuja and Jack R. Myers, "A Survey on Wireless Grid Computing" The Journal of Supercomputing, Springer Science + Business Media, LLC, Manufactured in the Netherlands, March 2006.

[12] Lee W. McKnight and James Howison, "Wireless Grids: Distributed Resource Sharing by Mobile, Nomadic, and Fixed Devices", IEEE Internet Computing, 2004.

[13] Ramandeep Kaur1 et.al, "New Fault Tolerance Approach using Antecedence Graphs in Multi Agent Systems", Proc. of Int. Conf. on Advances in Computer Science, 2010.

[14] Preetam Ghosh, "Mobility-Aware Efficient Job Scheduling in Mobile Grids", Seventh IEEE International Symposium on Cluster Computing and the Grid, July 2007.