Efficient Task Scheduling using Mobile Grid

Ashish Chandak[#1], Bibhudatta Sahoo[*2], Ashok Kumar Turuk[*3]

[#]*Department of Computer Science and Engineering,*
National Institute of Technology, Rourkela
[1]*achandak.nitrkl@gmail.com*
[2]*bdsahu@nitrkl.ac.in*
[3]*akturuk@nitrkl.ac.in*

Abstract— **Millions of PDA, i-phone, laptops are idle most of the time and this huge repository of resources cab be harness for computational purpose. In this paper, we integrate mobiles nodes with computing sites for task scheduling. We have shown the power of mobile nodes for computational purpose. Simulation results shows that task scheduling utility of application gets increased when mobile node used with sites.**

Keywords— **Mobile Grid, LAR, Dynamic Model.**

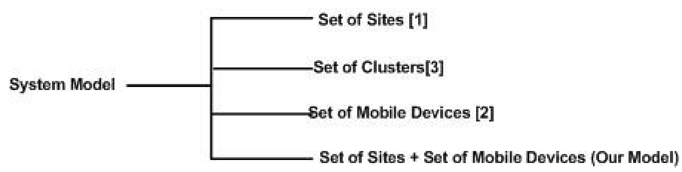
I. INTRODUCTION

Stock market portfolio Stock market portfolio management firm is facing challenges in managing their client portfolio. They need complex mathematical application that need huge computational resources and they are also under pressure to cut hardware and electricity expenses. But during business hours that have to handle massive transaction and to cope with this situation they kept large set of servers which become idle after business hours. This situation can be overcome by grid computing which can handle peak load at business hours and it takes less electricity and hardware. It provides resources beyond administrative boundaries and geographic locations. It provides pervasive computing. Entrepreneurs are imaging it would be like to flip a switch, access what computation power they need, and pay only for what they use [1,2].

If nodes in grid application come and go or are up only some of the time then static nodes are less efficient. To overcome this situation, we used mobile nodes in combination with computing nodes. Mobile nodes such as laptops, i-phone, PDA are present in almost all parts of continents. Mobile hosts are operating without any established infrastructure and centralized administration. Mobile host may not directly communicate with other host in single hope manner. In this case, multi hop scenario is used where route is established through intermediate nodes. Current grid application does not take mobile devices into consideration for computation purpose. Since power of mobile nodes is continuously increasing their power are not fully utilized so mobile devices can be considered for computational purposes. Thus mobile devices can be used as grid resources which can execute task. This paper harness computing capability of mobile node which are idle most of the time. They can be use with grid application for task scheduling.

The rest of the paper is organized as follows. Section 2 gives brief idea about various system models. Our model is presented in Section 3. Task scheduling in our model is discussed in Section 4. Simulation results are shown in Section 5. Finally, some conclusions are drawn in Section 6.

II. RELATED WORK



Various system model has been proposed in various literature [1] assumes set of sites while [2] consider set of clusters for computation.[3] takes into account set of mobile devices but in this paper, we are utilizing power of sites and mobile nodes.

III. DYNAMIC MODEL

All Fig. 2. illustrates an architecture for dynamic model. It consist of set of sites S= $\{S^1,S^2,S^3,\ldots\ldots.S^N\}$ and wireless cellular networks. Each site having M computing nodes M= $\{M^1, M^2, M^3\ldots M^J\}$. Wireless cellular network contains number of mobile devices and wireless service point (WSP). The resource associated with each mobile node is processing power. Here mobile devices act as resource provider. Here both sites and mobile devices used for task execution. The basic idea is to move task to such node that has sufficient CPU cycles to execute task. Mobile node need support from its neighbouring nodes to complete all the

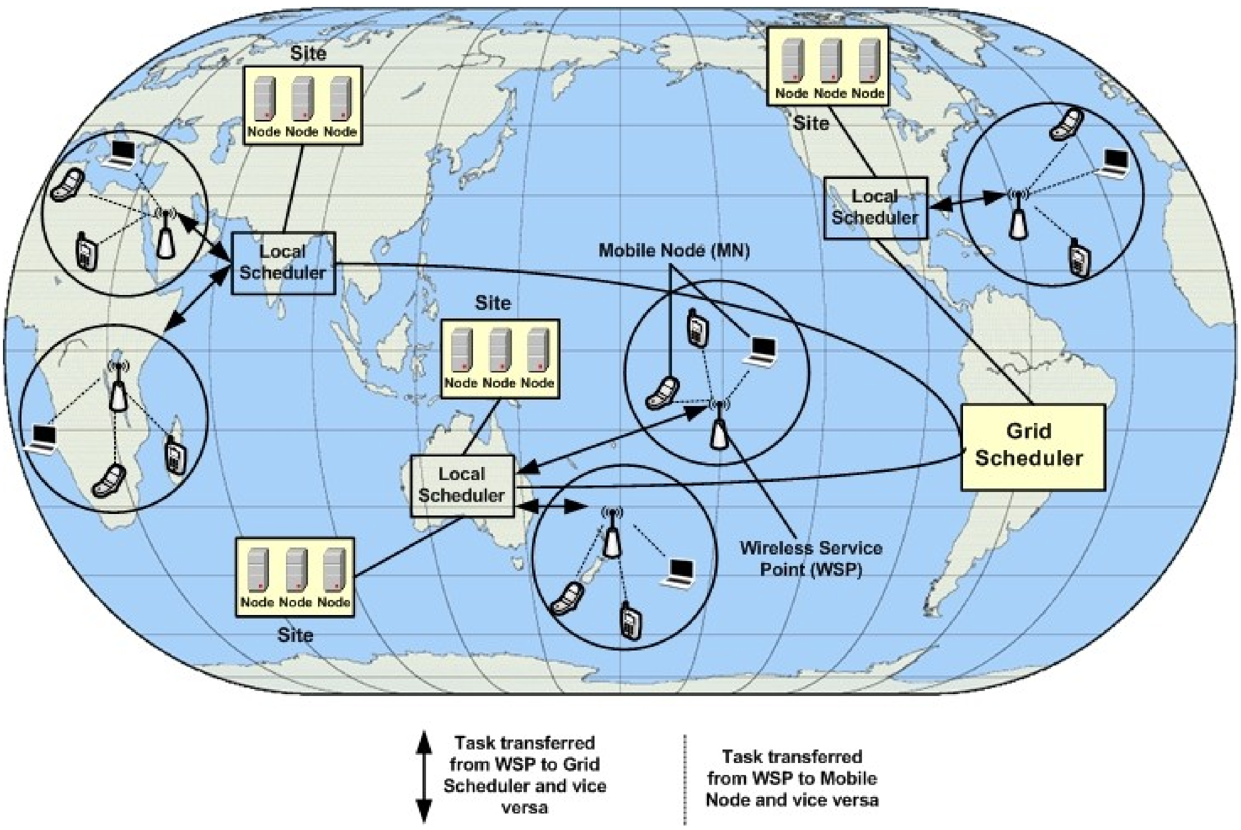


Fig.2 Dynamic Model

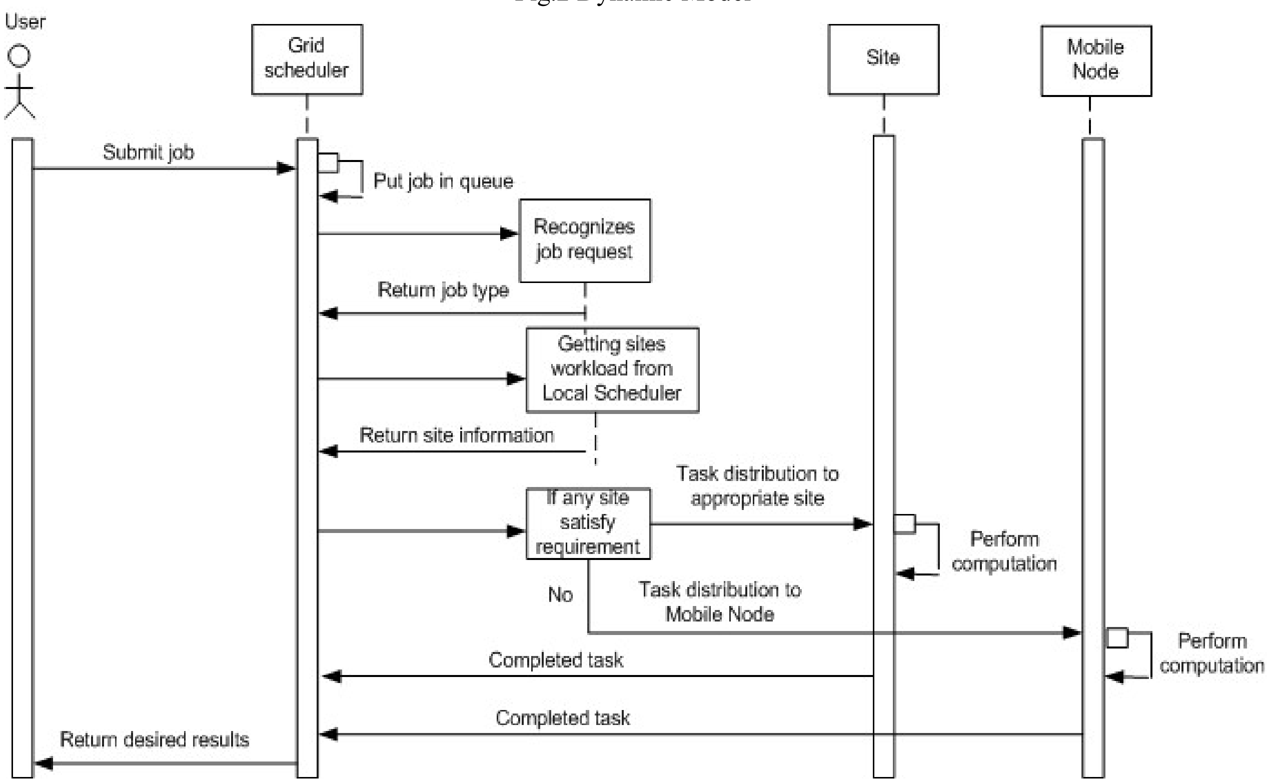


Fig.3 Sequence Diagram of Dynamic Model

task. So it must know capability of each node within wireless cell..

IV. DYNAMIC MODEL

Task scheduling in our model is shown by sequence diagram as shown in Fig 3. It consists of sites at which contain group of nodes and set of mobile nodes which are geographically distributed to serve incoming jobs. An arriving job that finds global scheduler busy signal then it is blocked from entering the system otherwise it is put in global queue. Grid scheduler checks workload and resource availability of each site and if any of the sites satisfy task request then it is forwarded to that site for execution.

If no site satisfies requirement or sites are busy then it forwards that job to wireless service point (WSP). WSP maintains status of each mobile node and forward job to appropriate mobile node. Scheduling of tasks is done by grid scheduler and starting of task at site is done by local scheduler. If sites are busy then the arriving job waits in queue to get service. Task service discipline is first-come, first-served (FCFS). Aborted job from site again comes to global queue. Jobs that are coming for execution in the grid scheduler are divided into two categories new jobs and squirted jobs where squirted jobs means jobs that are aborted from sites and they can be forwarded to mobile grid while new jobs means jobs that has not got any service from time of arrival. Finally, served jobs return to user.

A. Detailed description of task scheduling in mobile grid

Communication between mobile node and wireless service point is shown in Fig.4.WSP keeps table to maintain entry for each node and it periodically updates entry for each node in the wireless cell. It also maintain task retransmission list which contain entry for each task that is to be transmitted to node for execution. Here every node is equipped with global positioning system (GPS) so that WSP easily track each node. It also keep status of each node to identify battery power. When task is transmitted by scheduler to WSP first of all it checks status of each node and forward task to appropriate node for task execution. The basic idea is to move the task to such node that has sufficient CPU cycles to execute task. Before transmitting task to node WSP forward RTS (request to send) packet to mobile node with task information and mobile node after parsing job information send CTS (clear to send) packet to WSP. Mobile node needs support from its visited nodes to complete the task. It is keeping computing capability of each node within wireless cell. Task transfer between mobile node and wireless service point is shown in Fig.5.

Since each node is equipped with GPS we are using LAR protocol [6] for communication between nodes as shown in Fig.6.It uses GPS for obtaining the geographical position information necessary for routing. It uses two geographical regions for forwarding task, viz. RequestZone and ExpectedZone. The ExpectedZone is the region in which destination node is expected to be present, given information regarding its location in the past and its mobility information. If the information is not available then entire area is considered to be ExpectedZone. Sender determines RequestZone region in which path finding control packets (RouteRequest) are send from sender node and in response to RouteRequest packet Routereply packet is send from destination node. If sender node did not get RouteReply packet within sufficient time then in second attempt size of RequestZone is increased.

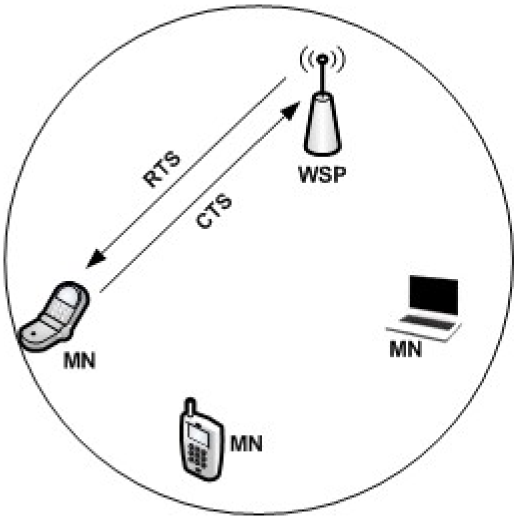


Fig 4. Communication between mobile node and wireless service point

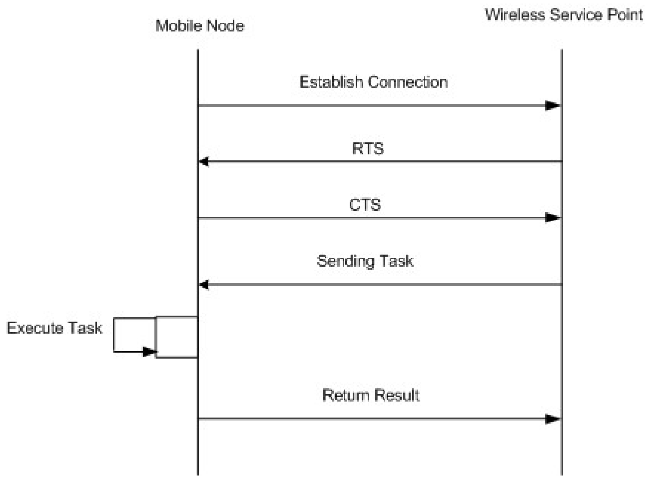


Fig 5. Communication between mobile node and wireless service point

V. PERFORMANCE EVALUATION

In this section, we evaluate performance of the sites and site with mobile node environment. We observe system for one hour and found out utility of given system. We have compared grid system utility using various heuristic. We compares computation of site without mobile node versus site and mobile node. Our simulation results shows that system utility gets increased when we consider computation of site and mobile node.

Utility=Executed Task/Number of Task

We assume one site having 5 computing nodes and mobile grid with 2 mobile devices. If site are busy then task are pass task to mobile hosts. We measured utility

.

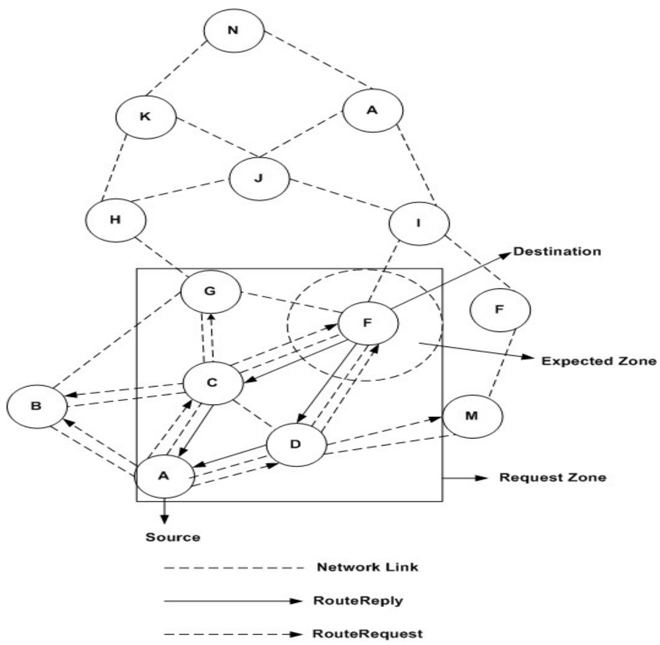


Fig. 6 Node Communication in Mobile Grid

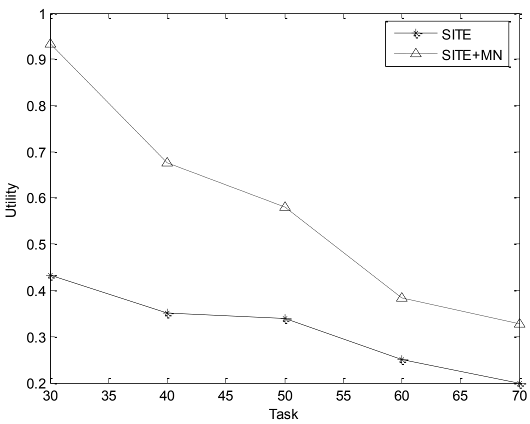


Fig.7 Utility Comparison FCFS Scheduling

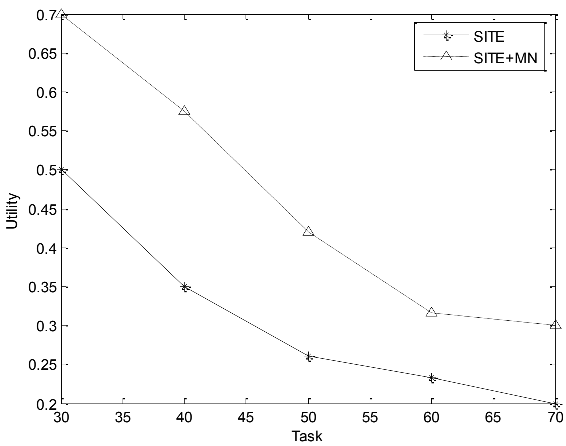


Fig.8 Utility Comparison OLB Scheduling

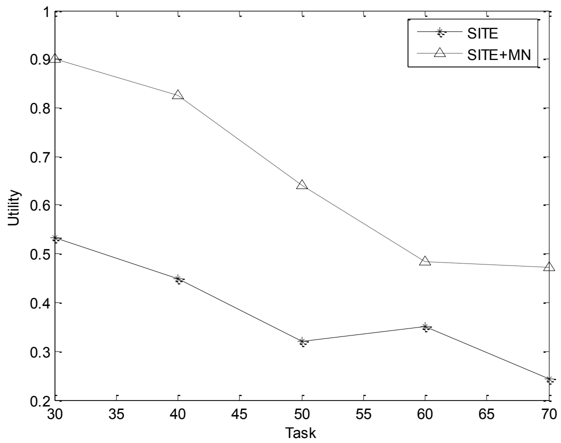


Fig. 9 Utility Comparison MCT Scheduling

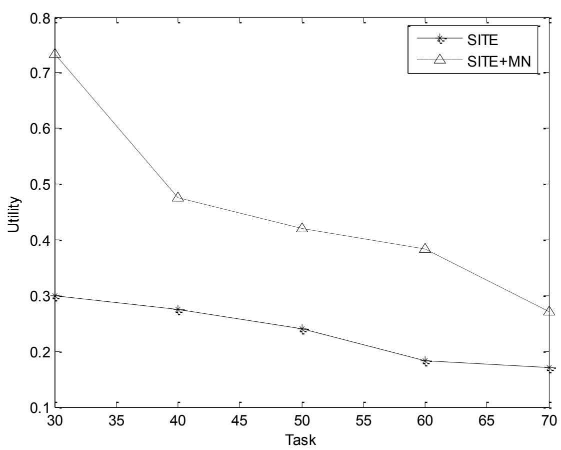


Fig. 10 Utility Comparison Min-Min Scheduling

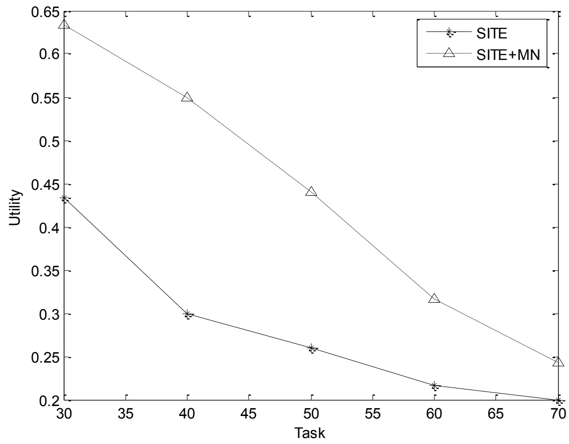


Fig.11 Utility Comparison Online Scheduling

Using various heuristic FCFS, OLB, MCT, Min-Min and Online and from fig. 7,8,9,10,11 we can see that system utility gets increased when we consider mobile nodes into consideration.

Conclusions

Since power of mobile devices increasing day by day they can be use for computational purpose. But still there are some limitation such battery life, memory requirement. In this paper, we exploit the potential of mobile devices by taking them into consideration in grid application. In our model mobile node are used with sites and they can distribute task among themselves if computation is not possible by single mobile node. In order to measure utility of application, we measure utility using various heuristic. The simulation result shows that the application utility gets increased when we consider computing capability of mobile node and sites together.

REFERENCES

[1] Riky Subrata, , Albert Y. Zomaya, and Bjorn Landfeldt, Cooperative power-aware scheduling in grid computing environments, *Journal of Parallel and Distributed Computing,* Volume 70, Issue 2, February 2010, pp. 84-91 .

[2] Li Chunlin, Li Layuan, An economics-based negotiation scheme among mobile devices in mobile grid, *Computer Standards & Interfaces*, Volume 33, Issue 3, March 2011, pp.220-231.

[3] Bahman Javadi, , Mohammad K. Akbari, and Jemal H. Abawajy, Analytical communication networks model for enterprise Grid computing, *Future Generation Computer Systems*, Volume 23, Issue 6, July 2007, pp. 737-747.

[4] Ian Foster, Carl Kesselman, and Steven Tuecke. The anatomy of the grid: Enabling scalable virtual organizations. International Journal High Performane Computing Application,15:200-222, 2001.

[5] Carl Kesselman Ian Foster. The Grid 2: Blueprint for a New Computing Infrastructure. ELSEVIER,Second edition.

[6] Y. Ko and N.H.Vaidya, "Location-Aided Routing(LAR) in Mobile Ad Hoc Networks", Proceedings of ACM MOBBICOM 1998, pp.66-75, October 1998