CHAPTER 9

CONCLUSION & FUTURE SCOPE

Distributed computing emerged from decade to decade in the form of cluster, grid and cloud computing; has gained more popularity due to its capability to share the resources with low cost and more reliability. The problem of task scheduling in such environment deals with the mapping of user’s tasks to the distributed resources considering all application’s requirements and provider’s benefit. Keeping this view in mind, few techniques have been developed and presented in this thesis.

9.1 CONCLUSION

- **Metaheuristic Based Workflow Scheduling in Cloud Environment:** The workflows typically involve complex data of different sizes and poses huge computational requirements. The execution of such complex workflow requires an optimum task scheduling technique, which can arrange the task on diverse resources to get the lowest execution time and better resource utilizations, while the workflow rules are not undermined. A modified genetic algorithm is proposed and implemented to optimize the schedules of workflow application in cloud environment so as to minimize the makespan of such applications as well as to utilize the resources in an efficient way. The performance of proposed algorithm is tested for three standard workflow applications (Montage, Fork-Join, Epigenome) under various load and scalability conditions. The results confirmed the capability of proposed algorithm in generating better solutions as compared to traditional genetic algorithm.

- **Genetic Based Secure and Independent Task Scheduling:** Security has been considered as one of the key factor in the adoption of any distributed environment. Scheduling of applications in a secure distributed environment
demands the mapping of tasks on to those resources that can meet the task’s security requirements. A heuristic based security aware algorithm has been proposed for scheduling of independent tasks in a distributed environment with an aim to improve the makespan and resource utilization while keeping security overhead to the minimum.

- **Meta Heuristic based Task Scheduling in Distributed Environment:** An attempt has been made to highlight the importance of metaheuristics in solving the task scheduling problem for distributed environment. An outline of the most commonly used metaheuristics has been presented followed by a comparative analysis of each such metaheuristic related to task scheduling. The survey also includes the close examination of the performance of hybrid metaheuristics presuming that this study will help the researchers to get insight into most appropriate techniques for scheduling independent tasks/workflows in distributed environment under the given constraints.

- **Fuzzy Based Trust Management System for Cloud Environment:** Cloud promises for easiness and reduced expense to service providers and consumers. However, a lack of trust between these two stakeholders has hindered the universal acceptance of cloud for outsourced services. The consumer reluctance in adoption of cloud computing due to its data under the control of the other, unclear security assurance and lower transparency is justified to some extent. A fuzzy based trust management system is proposed to facilitate cloud consumers in identifying trustworthy Cloud Service Provider (CSP) from the available ones. A trust value for each CSP based on the four basic parameters: security, availability, cost and performance is evaluated using fuzzy logic. These input parameters to fuzzy model are calculated based on the simulation results of cloud analyst.

- **Energy-Aware Virtual Machine Placement in Cloud Datacenter:** Due to ever increasing demand of cloud computing, the operational cost of datacenters has increased many folds and is of major concern for the cloud providers. The reduction in the energy consumption of the servers and
communication networks can significantly improve the overall operational cost of datacenters. The efficient virtual machine placement can optimize the utilization of server and network resources resulting in energy efficient datacenters. A genetic algorithm is proposed for addressing the multi-objective VM placement problem aiming to simultaneously reduce the server and network energy consumption. The VM’s resource requirements, PM’s capacity, topology of network elements are modeled as random variables and correlation among them is considered. The simulation results confirm the effectiveness of proposed approach as compared to other traditional VM placement algorithms in terms of energy-efficiency.

9.2 FUTURE SCOPE

- As cloud offers resources on-demand based on pay-per-usage model so the scheduling of user’s applications under different cloud pricing model can be of great interest.

- Although the service provider tries to ensure the reliability of the cloud environment, still the reliability factor must be taken into account while distributing tasks among several VMs. The impact of VM failure will be many folds in case of workflow scheduling due to task dependencies constraints.

- The proposed Trust Management System facilitates the cloud consumers in identifying the trustworthy cloud service providers on the basis of their trust values. The utility of proposed system can be enhanced by integrating a mechanism based on mobile agent technology to identify and overcome the various intrusions in the system. The use of mobile agents to collect the information pertaining to malicious candidates will reduce the traffic on the network mainly caused due to information exchanged between various system entities. Besides, this the probability of the interception of information exchanged in the network by malicious candidates is also reduced.
An extensive review of recent proposals for scheduling techniques reveals that a lot more dimension are yet to be explored in terms of datacenter cost, virtual machine migration, energy consumption and Service-Level Agreement etc.

Energy consumption of data centers is a vital issue in cloud environment; it necessitates the development of efficient energy conservation algorithms. An attempt has been made in the proposed work to reduce both the computational and communication cost of the datacenter by applying genetic approach for initial VM placement. The proposed work can be extended for the implementation of dynamic virtual machine placement to reduce the datacenter cost.