CHAPTER 7

CONCLUSION AND SCOPE FOR FURTHER RESEARCH

7.1 CONCLUSION

The Grid computing technologies pose difficult challenges in achieving better reliability in job completion, execution time performance improvement, fairness and overhead cost. The existing fault tolerance techniques based resource allocation method assumes the same fault tolerance is adopted in all computing resources. Some studies and investigations show that different fault tolerance supported resources are adopted. To achieve better reliability and scheduling performance, scheduler combined with fault tolerance technique work were presented in this thesis.

A proposed new threshold based scheduler (NTBS) grants resource for the active user jobs whose execution time is more than or equal to the required threshold value. Here, threshold is computed based on average of active user execution time. This scheduler achieves better execution time performance as compared to FCFS, EDF, FPLTF without compromising fairness and complexity. NTBS makespan performance is improved by 2% as compared to EDF and easy backfilling scheduling, 2.89% as compared to FPLTF scheduling, 3.1% as compared to Min-Min scheduling and 4.3% as compared to FCFS and LTF.

To improve the job reliability without affecting the makespan and turnaround time performance, an effective hybrid scheduling (EHS) was designed. This EHS combines the best performance regions of Easy backfilling, FPLTP and NTBS. Hence, EHS performance is always
found to be better than other schedulers. The EHS scheduling with job retry mechanism and job checkpointing mechanism is implemented to achieve better job reliability. It is found that the proposed EHS with job checkpointing mechanism achieves 3.3\% improvement in makespan performance compared to FPLTF and Easy backfilling algorithms.

It is also observed that in all conditions, the makespan and turnaround time performance of EHS with job retry mechanism and job checkpointing mechanism is found to be good as compared to NTBS and other schedulers. The main observation in EHS is, that EHS with job checkpointing mechanism achieves 1.5\% improvement in makespan performance compared to EHS with job retry mechanism.

In EHS, if resource failure occurs, the job will be migrated to another resource once. If the migrated node also got failed, the user jobs will not be completed. To reduce this kind of job incompletion, a new failure based resource allocation technique, FRAT was proposed with the aim of attaining better job reliability along with better execution time performance.

In FRAT, three fault tolerance techniques namely Retry Mechanism, Alternate Resource Mechanism and Checkpointing Mechanism adopted resources are used for the runtime performance comparison. The expected execution time of different fault tolerance mechanisms is computed. The expected execution time and overhead performance of the proposed Failure based Resource allocation technique using MOGA (FRAT-MOGA) is compared with existing integrated algorithm, min-min algorithm.

From the experimental result, it is observed that the expected execution time performance of FRAT is found improved by 8.6\% compared to the integrated algorithm when the failure rate is 70\%. It is also observed that there is 35\% improvement in expected execution time performance of FRAT compared to integrated algorithm when the
failure rate is 10%. When the failure rate is increased to 90% the expected execution time performance is almost similar for both algorithms.

It is observed that, FRAT achieves better expected execution time at the higher overhead cost. The Pareto optimal solution for the multi objective problem stated for the FRAT is obtained and plotted. This shows that, when an optimum execution time is expected, it is obvious that an associated overhead cost is compulsorily involved. By this result, it is concluded that the FRAT solutions (schedules) are optimized to a conformed and acceptable overhead value.

7.2 RESEARCH CONTRIBUTIONS

In brief, the research contributions of this work are summarized below:

i) Design and development of a New Threshold Based Scheduler to minimize the makespan and turnaround time with fair service.

ii) Design of an Effective Hybrid Scheduler (EHS) for Checkpoint based Grid environment to improve the reliability by implementing fault tolerance technique.

iii) Formulation and development of a Multi-objective Genetic Algorithm (MOGA) based resource scheduling algorithm, Failure based Resource allocation technique using MOGA (FRAT-MOGA) for allocating the user jobs to the grid resources in a near optimal manner.

iv) Simulation of the proposed scheduling algorithm to validate the effectiveness of the proposed approach.
7.3 SCOPE FOR FURTHER RESEARCH

The objective of improving the execution time with job reliability, fairness with acceptable overhead is achieved by the proposed resource allocation technique. In future, this work may be extended to study and evaluate the performance with replication techniques.

This work can also be extended with more number of migration nodes to improve the job completion reliability.