ISSN 2515-8260 Volume 07, Issue 09, 2020

# ENHANCED PERFECT – GLOBAL SCHEDULER FOR GRID COMPUTING ENVIRONMENT TO IMPROVE THE RESOURCE SCHEDULING ALGORITHMS

Dr. E. Chandra Blessie
*Professor & Head, Department of Computer Applications, Nehru College of Management Coimbatore, Tamil Nadu.*

P.Pradeep Kumar
*Assistant Professor, Department of Information Technology, Bharathidasan College of Arts and Science Erode, Tamil Nadu.*

***Abstract***

***Grid computing is a group of computers that are physically connected to perform dedicated tasks together over a network or the Internet, such as analyzing e-commerce data, solving a complicated problem, and other complicated jobs. In this new market, several companies and research organizations have previously worked to solve current problems and are now in the process of developing existing working methods to achieve better results. In this paper, the authors proposed an improved model to boost the efficiency of some existing methods in the resource scheduling algorithm that includes Semi – Global Scheduler and Perfect – Global Scheduler. The job assigning based method is handled in the proposed method to improve the efficiency and performance of the resource allocation schedulers. In the comparison section, it shows that better results were provided by the proposed model than by some existing models. In order to sustain the efficiency needed for real-time scenarios, grid computing must be improved with a certain interval limit.***

***Keywords***

***Grid Computing, Semi-Global Scheduler, Resource Scheduling, Perfect Global Scheduler, Local Scheduler, Global Scheduler, Resource Allocation.***

## 1. Introduction

Grid computing is a collection of physically connected computers (over a network or over the Internet) for the purpose of collectively performing specific tasks, such as analyzing e-commerce data and resolving a complex problem. Grid computing is a super virtual machine

built to solve or satisfy a specific application requirement. It provides users with ability to access various types of remote resources using computer network connectivity substructures and distributed systems.

The Grid Computing is defined as *"A type of parallel and distributed system that enables the sharing, selection, and aggregation of geographically distributed autonomous resources dynamically at runtime depending on their availability, capability, performance, cost, and users' quality-of-service requirements"*. Figure 01 illustrates the working and connecting model of grid computing and its related resource management system.

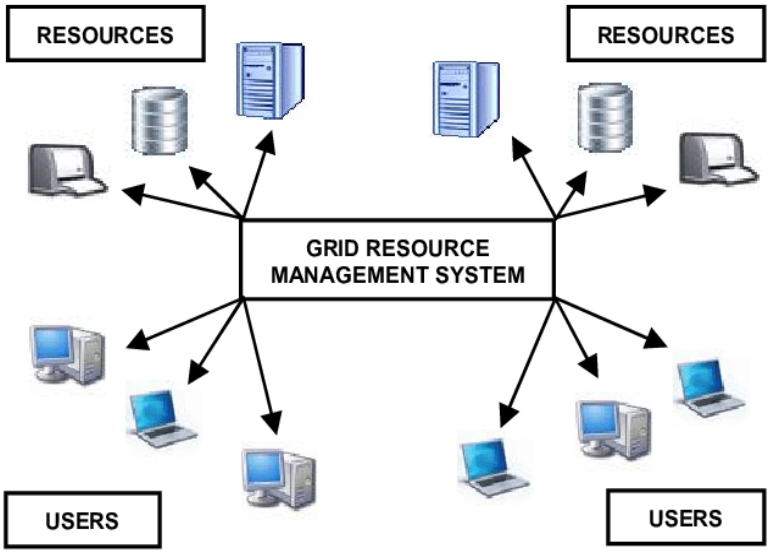



***Figure 01 Grid Computing and Resource Management System***

Applications of the Grid Computing classified as: *Scheduler, Resource Broker, load-balancing and Grid portals*. Schedulers are types of work management applications, such as allocating resources that are required for any particular job, job partitioning to schedule concurrent execution of tasks, data management, event correlation, and capabilities for service-level management. Resource Broker provides services for the pairing between the requesting service and the provider of the service. This pairing allows the best available personnel from the service provider to be chosen for the execution of a particular mission. Load-balancing problems of the Grid Computing infrastructure involve the conventional load-balancing distribution of workload among the resources in a Grid Computing environment. To avoid processing delays and over-commitment of resources, this load-balancing function must always be implemented

into any device. Grid portals are similar to Web portals in that they provide consistent access to the resources of the grid.

Resource Scheduling refers to the collection of actions and methodologies used by various organizations to effectively allocate the resources they have to jobs, tasks or projects they need to complete, and to plan start and end dates based on resource availability for each task or project. There are six types of scheduling algorithms available for processes, which are: *First Come First Serve, Shortest-Job-First, Scheduling Shortest Remaining Time, Priority Scheduling, Round Robin Scheduling and Multilevel Queue Scheduling.*

***Motivation and Objective behind the Research Work:***

- Resource management and scheduling plays a crucial role in achieving high utilization of resources in grid computing environments.
- The allocation of distributed computational resources to user applications, is one of the most challenging and complex task in Grid computing.
- The problem of allocating resources in Grid scheduling requires the definition of a model that allows local and external schedulers to communicate in order to achieve an efficient management of the resources themselves.
- In order to rectify the allocation problem, this research work proposed new resource allocation model to overcome the disadvantages.

This paper is organized into five sections: Section 2 describes the related works of grid computing models especially in the area of resource scheduling. Section 3 presents the proposed methodology framework named as Semi-Global Scheduler and Perfect Global Scheduler. Results and discussions are demonstrated in section 4. Finally, this paper concludes with the conclusion and future enhancements which are discussed in section 5.

## 2. Review of Literature Review

Mateusz Andrychowicz 2018 presented the method for minimization of power losses in distribution system. Main aim of the method is to minimize power loses in analyzed distribution system at the assumed share of renewable energy in local demand. To achieve the best result, Energy storage and the grid development measures are examined on the optimization model,

whose task is to minimize power loss through appropriate allocation and sizing of Renewable Energy Source. The operating status of the system reflects the power flows, power losses and voltage levels used in the model. In addition, real generation and demand profiles are used in the optimization process.

Seyyed Mojtaba Ahmadi et al. 2013 studied the effect of homogeneous or inhomogeneous agents and also using an identical case base or several discrete case bases for final answer so that each base pertains to one of the agents. Authors used two different models such as systems with several discrete case bases and another for systems with only one common case base. The agents use ICBR-LA procedure in homogeneous methods and different kinds of CBR procedures like CBR-LA and ICBR-LA and also Max-Min and Min-Min methods in inhomogeneous cases. The scheduler agent chooses a method for solving a problem according to mentioned methods and sends it to other agents.

A preference-based approach is proposed by Victor Toporkov et al. 2016 for Grid computing with regard to preferences given by various groups of virtual organization (VO) stakeholders (such as users, resource owners and administrators) to improve overall quality of service and resource load efficiency. A specific cyclic job batch scheduling scheme is examined which performs job flow meta scheduling balancing between the VO stakeholders' conflicting preferences and policies. Two different metrics are introduced to find a scheduling solution balanced between VO stakeholders. Additionally, two job batch-slicing procedures are proposed to establish equality when scheduling jobs with different preferences types. In the framework of the cyclic scheduling scheme (CSS) the approach is proposed which involves user utility combined with time and cost criteria for overall scheduling efficiency estimation. In their work, the relative utility function based on the relationship to user-defined optimization criterion was considered and studied.

Shashi Bhushan Semwal and Amit Das, 2015 presented the effective time and cost-scheduling techniques followed by the scheduler decide the Grid system throughput and consumption of the source in to the grid. At the present time parallel and distributed systems are modify in the association and the idea of Grid computing, a group of dynamic and heterogeneous resources linked via Internet and linked by many and many clients, is currently suitable a

certainty. The Grid system is dependable f or the implementation of task submits to it. The superior Grid system will contain a job scheduler, which mechanically finds the most suitable machines on which a specified job is to run. This source range is very significant in dropping the total implementation time and cost of processing the jobs, which depends on the job scheduling algorithm. The algorithms contain executed to schedule different random DAGs onto various grids of mixed clusters of different sizes. The schedule produced by ETCTSGC algorithm is improved than other joined bi-criteria algorithms in admiration of together execution time and cost-effective.

## 3. Methodology

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. The proposed methodology named as Perfect – Global Scheduler.

The objective of the proposed methodology is:

- The problem of allocating resources in Grid scheduling requires the definition of a model that allows local and external schedulers to communicate in order to achieve an efficient management of the resources themselves.
- In order to rectify the allocation problem, this research work proposed new resource scheduling and resource allocation model to overcome the disadvantages.
- The proposed model needs to design with two conditions. The Local scheduler need to refresh itself within a certain period of interval or whenever a new job assigned to it. Then in the same way it needs to communicate with the global scheduler.

### *S-GL&RA vs. P-GL&RA*

The continuous research mode is a perfect way to figure out the efficiency and performances of the newly proposed or improved methodology with the other existing methodologies. This research work is also a continuous research mode concept based, i.e., already the S-GL&RA was developed, implemented and tested with the standard dataset [17]. In

this research article, the P-GL&RA is developed, implemented and tested with the standard dataset. This dataset which was used in the testing of S-GL&RA is used for the P-GL&RA too. The major differences between the S-GL&RA vs. P-GL&RA are listed below:

- The S-GL&RA was structured by the concept of certain fixed interval limit based. Whenever the work assigned in the local scheduler, then that will be taken into consideration at the time of updating the next slot only. For Example: Local Scheduler updating is fixed with 20 minutes time interval, then the work assigned at 21$^{st}$ minute means that work needs to be wait for updating of next slot (it will not be assigned to GS and it will be remained in Local Scheduler for next 19$^{th}$ minutes). Due to fixed limit of interval scanning, then the processing time of the work will also increase.
- In working stricter of the P-GL&RA is improved than the S-GL&RA, here whenever the work is entered into the Local Scheduler, then that information will be transferred the Global scheduler. After that that will be updated in the Global Scheduler and assigned the available resource based on the resource allocation methodology. The waiting time of the word is reduced in the P-GL&RA. But it may lead to utilize the more resource and it raises the cost by default. Instead of using these methodologies individually, the both S-GL&RA and P-GL&RA can be used in the Hybrid method. In hybrid method, based on the requirement it may choose either S-GL&RA or P-GL&RA.

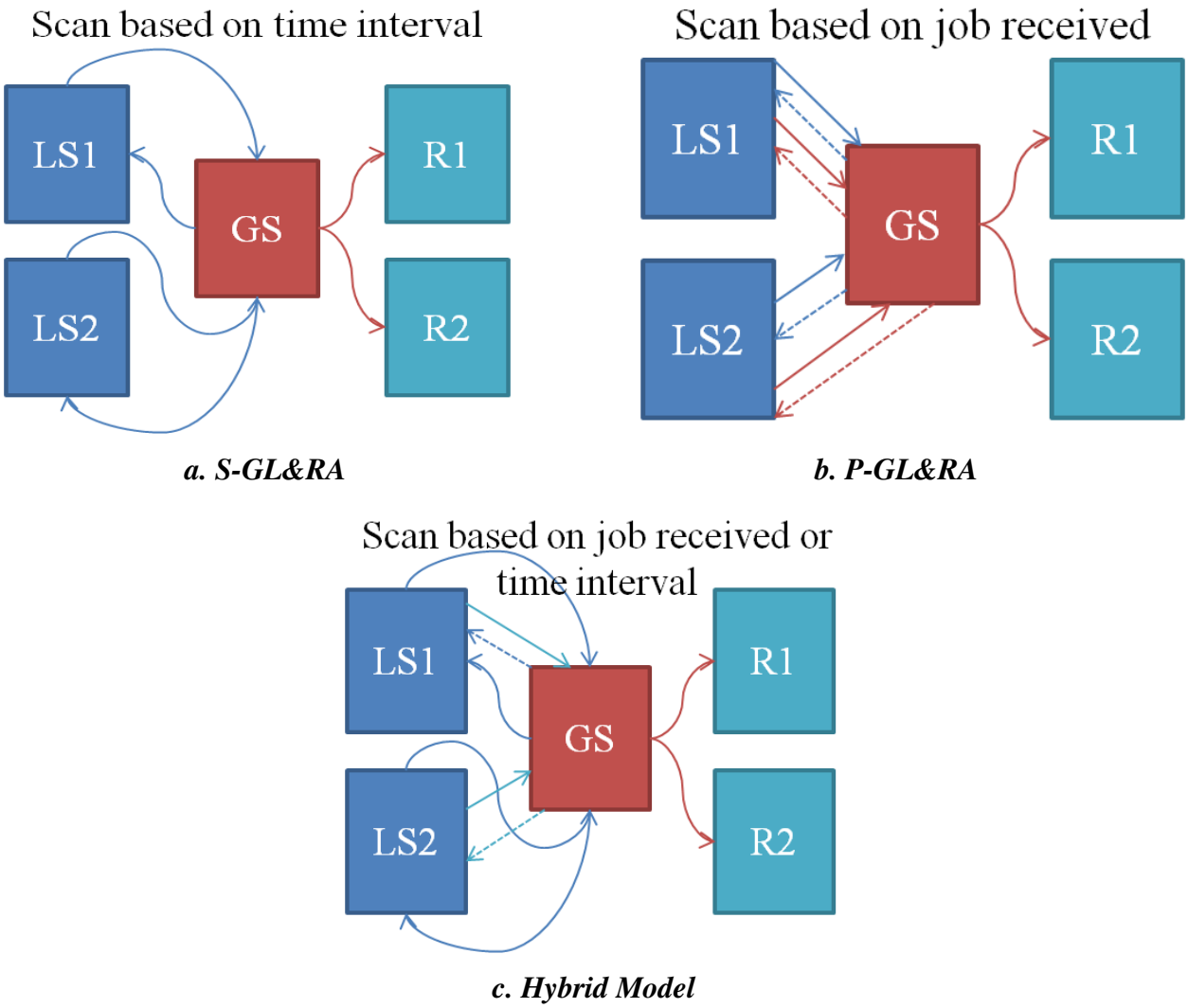
***Pseudo code for S-GL&RA vs. P-GL&RA vs. Hybrid Model***

***Table.01.Pseudo code of the S-GL&RA vs. P-GL&RA vs. Hybrid Model***

| **Method** | ***Pseudo code*** |
|---|---|
| **S-GL&RA** | Job reached LS<br>Wait up-to next scan time<br>Update Job to GS at Scan time to fulfill update process<br>Check the resource availability from GS<br>If Resource Available Then<br>Assign the job to available resource<br>Else If Check the Resource which is going to finish job first Then a<br>Assign the job to that resource in the Queue manner<br>Else |

| | |
|---|---|
| | Again start the process from resource verification to assign job |
| **P-GL&RA** | Job reached LS<br>Send intimation to GS<br>Update Job to GSusinginstant Scan for update the job process based on intimation<br>Check the resource availability from GS<br>If Resource Available Then<br>Assign the job to available resource<br>Else If Check the Resource which is going to finish job first Then a<br>Assign the job to that resource in the Queue manner<br>Else<br>Again start the process from resource verification to assign job |
| **Hybrid Model** | Job reached LS<br>Send intimation to GS<br>Verify whether the fixed scan waiting time<br>If the scan time is lesser than one minute Then<br>Wait for the fixed waiting time scan<br>Else<br>Send the intimation to GS regarding instant scan for update process based on intimation<br>Update job process to GS:<br>Update Job to GS using instant Scan for update process based on intimation or Update Job to GS by using certain interval Scan time to fulfill update process; which is earlier then that method will be applied for job updating in-to GS<br>Check the resource availability from GS<br>If Resource Available Then<br>Assign the job to available resource<br>Else If Check the Resource which is going to finish job first Then a<br>Assign the job to that resource in the Queue manner<br>Else |

| | |
|---|---|
| | Again start the process from resource verification to assign job |




***a. S-GL&RA*** ***b. P-GL&RA***

***c. Hybrid Model***

***Figure.2.(a) S-GL&RA working model, (b). P-GL&RA Working model (c). Hybrid model***

The table 01 and the figure 02 (a), (b) and (c) denote the pseudo code comparison and working model comparison. This shows that S-GL&RA is differed from model of P-GL&RA. Hybrid Model can be created to avoid the using of proposed P-GL&RA and S-GL&RA by separately. Figure 03 illustrates the Proposed Methodology in diagrammatical manner.

***Procedure of the proposed methodology***

The working model of the projected methodology is elucidated in the form of step by step procedure manner. That procure of the projected methodology is listed in the table 02. In this proposed model the four local schedulers are placed to explain the projected methodology.

***Table.02. Proposed Methodology Procedure P-GL&RA***

| | | |
|---|---|---|
| Step 01 | : | Start the process |
| Step 02 | : | Create the local scheduler and assign the local scheduler name as LS1, LS2, LS3 and LS4 |
| Step 03 | : | Create a global scheduler and assign the name as GS, then interlink the LS1, LS2, LS3 and LS4 in to the GS |
| Step 04 | : | Generate the resources which are named as R1, R2, R3 and R4 with interconnection method and then linked that generated resources R1, R2, R3 and R4 to the GS |
| Step 05 | : | Collect the jobs from the required persons under the LS1, LS2, LS3 and LS4 |
| Step 06 | : | Apply the load balancing method into the LS1, LS2, LS3 and LS4 to make that in balancing order |
| Step 07 | : | Condition one - Refresh the LS1, LS2, LS3 and LS4 in permitted interval period to verify where there is any new job is assigned into those above mentioned Local Schedulers |
| Step 08 | | Condition two - When new job is entered and assigned into any one of the Local Schedulers i.e., LS1, LS2, LS3 and LS4, then refresh the LS1, LS2, LS3 and LS4 and send the new job assigned information to the global scheduler. Here the both the conditions will active. Whatever condition happens first and that will take into consideration. |
| Step 09 | : | Condition one - Refresh the GS in permitted interval period to verify where there is any new job is assigned from the LS1, LS2, LS3 and LS4 Local Schedulers to GS |
| Step 10 | | Condition two - Refresh the GS whenever a new job assigned information received from the Local Schedulers i.e., LS1, LS2, LS3 and LS4. Here the both |

the conditions will active. Whatever condition happens first and that will take into consideration.

| | | |
|---|---|---|
| Step 11 | : | Verify that the refreshing method of the Local Schedulers and Global Scheduler into automatic way or not. It must be in automatic manner |
| Step 12 | : | Based on the job nature and also the Local Schedulers nature, the jobs allocated to the available resources by the GS in the utilization manner |
| Step 13 | : | Confirm the above mentioned working procedures and processes again |
| Step 14 | : | Continues the process up-to the jobs turned into zero in the LS1, LS2, LS3 and LS4 |
| Step 15 | : | Finalize and confirmed that the LS1, LS2, LS3 and LS4 are Nil |
| Step 16 | : | Stop the process |

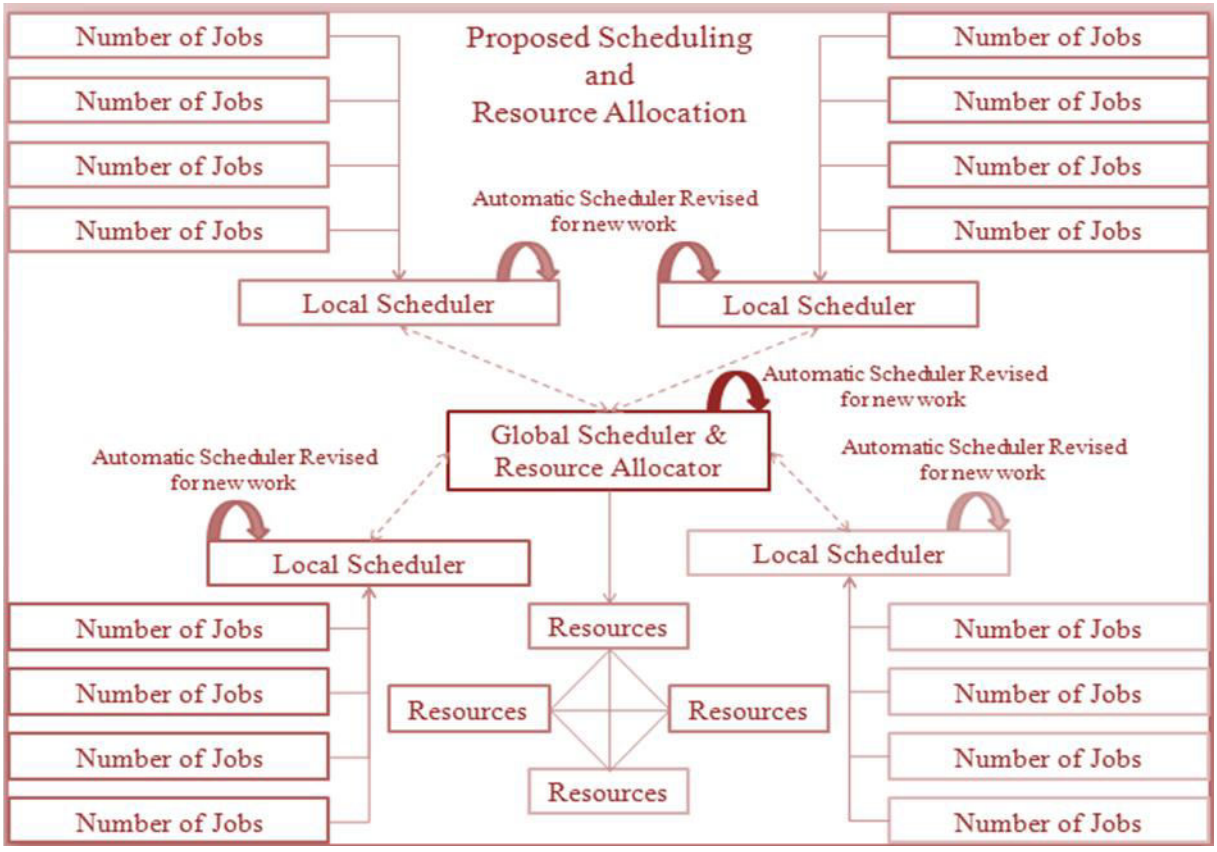



***Figure.03. Work Flow of Proposed Methodology***

ISSN 2515-8260 Volume 07, Issue 09, 2020

## 4. Results and Discussion

The results and discussion is the subdivision where the position to evaluating the efficiency and performance of the projected methodology with some of the presented methodologies by using the universal data. The table 03 and figure 04 show and demonstrates the similarity between projected methodologies with presented methodologies by using the universal job distribution method. The proposed algorithm of P-GL&RA is simulated in the GridSim grid environment simulator. *(GridSim: The GridSim toolkit allows modeling and simulation of entities in parallel and distributed computing (PDC) systems-users, applications, resources, and resource brokers (schedulers) for design and evaluation of scheduling algorithms.)*

***Table.03. Comparison between proposed methodologies with existing methodologies***

| Algorithm | Task 1 | Task 2 | Task 3 | Task 4 | Task 5 | Task 6 |
|---|---|---|---|---|---|---|
| NG | 934 | 875 | 819 | 756 | 679 | 612 |
| SGA | 835 | 789 | 736 | 699 | 645 | 590 |
| RQSG | 800 | 760 | 720 | 685 | 632 | 582 |
| RQSG 1 | 790 | 754 | 712 | 678 | 625 | 575 |
| S-GL&RA | 985 | 899 | 855 | 801 | 750 | 700 |
| P-GL&RA | 995 | 920 | 875 | 830 | 775 | 723 |

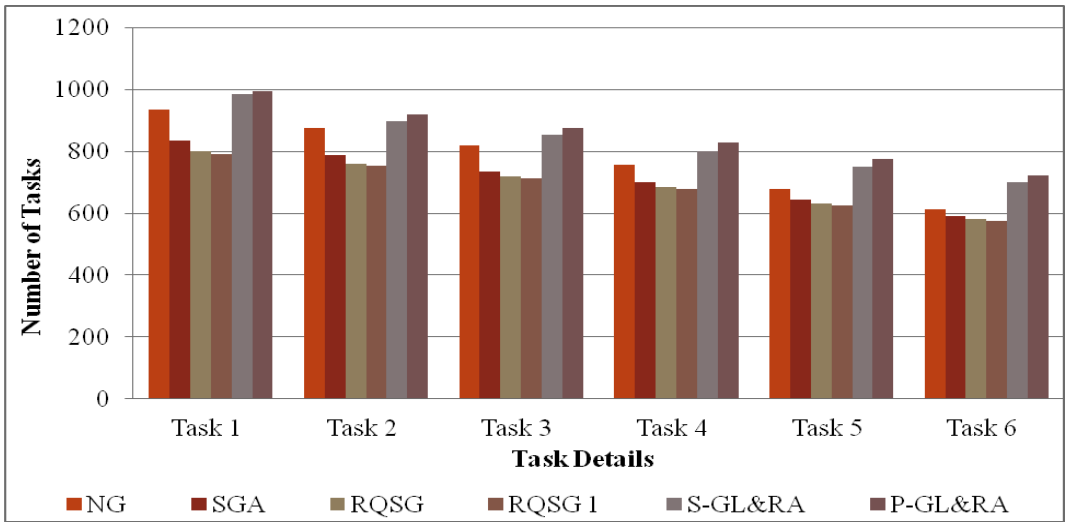


***Figure.04.Comparison between proposed methodology with existing methodologies***

The NG, SGA, RQSG, RQSG 1, and S-GL&RA related information are taken as benchmark details from [17, 18]. Based on the future work, future extension and limitations of those papers were considered and the improved model was proposed in this research paper. To verify the effectiveness and performance of the projected method, the six tasks were taken and applied those six tasks on the proposed and presented methodologies. The comparison stated that the proposed method is performed better than minimum of 6.5% to maximum 9.85% than the presented methodologies in an effective manner.

The proposed model can be suited for the banking scenario (the explanation is provided for understanding purpose, in real time it needs more verification and validation to implement). The National Electronic Funds Transfer (NEFT) is available on a 24 x 7 model basis and the Real-Time Gross Settlement's (RTGS) settlement is not available on a 24 x 7 model basis. The fund limit has also differed in these systems. To make this both NEFT (immediate intimation method, i.e., P-GL&RA) and RTGS (Certain internal scan method, i.e., S-GL&RA) available in one model, the hybrid model (merging of S-GL&RA and P-GL&RA) can be used. While combined these two models, the process can be done using either one method based on that which model took less time to complete the process.

## 5. Conclusion and Future Enhancement

Due to the developing rate of trade, industry and science world, scheduling is considered as one of the main discussions in grid environment. As providing scheduling algorithms which can minimize tasks runtime and increase operational power has remarkable importance in these categories. Along with, there are algorithms which meet the needs as far as possible which is noted to a few of them in this research work. Grid scheduling system and various types of challenging features in grid are discussed in this research work to get familiar with scheduling challenges.

The Semi – Global Scheduler with Resource Allocation algorithm and Perfect – Global Scheduler with Resource Allocation algorithm was removing some of the discussed challenges. The proposed Semi – Global Scheduler with Resource Allocation algorithm and Perfect – Global

Scheduler with Resource Allocation algorithm were applied and tested in particular sector data purpose only. In future it will be extended to the remaining different sector data too.

**Abbreviations**

**SGA** – Simulated annealing-like Genetic Algorithm, **S-GL&RA** – Semi Global Loader and Resource Allocation, **P-GL&RA** – Perfect Global Loader and Resource Allocation, **PDC** – Parallel and Distributed Computing, **GS** – Global Scheduler, **LS** – Local Scheduler

**References**

1. Amudha T, T Dhivyaprabha, "QoS Priority-Based Scheduling Algorithm and Proposed Framework for Task Scheduling in a Grid Environment", International Conference on Recent Trends in Information Technology, IEEE, 2011.
2. Murugesan, C. Chellappan, "An Economic-based Resource Management and Scheduling for Grid Computing Applications", IJCSI International Journal of Computer Science Issues, Volume 7, Issue 2, 2010, pp. 20-25.
3. Farhad Soleimanian Gharehchopogh, Majid Ahadi, Isa Maleki, Ramin Habibpour, and Amin Kamalinia, "Analysis of Scheduling Algorithms in Grid Computing Environment", International Journal of Innovation and Applied Studies, Volume 4, Issue 3, 2013, pp. 560-567.
4. Harshadkumar B. Prajapati, Vipul A. Shah, "Scheduling in Grid Computing Environment", Fourth International Conference on Advanced Computing & Communication Technologies, IEEE, 2014, pp. 315-324.
5. MassimilianoCaramia, Stefano Giordani, "Resource Allocation in Grid Computing: An Economic Model", WSEAS Transactions on Computer Research, Issue 1, Volume 3, 2008, pp. 19-27.
6. Mateusz Andrychowicz, "Optimization of distribution systems by using RESallocation and grid development", IEEE, 2018.
7. Miguel Pinto, Orlando Belo, "Allocating Data Cubes on a Grid Environment", International Conference on Systems, Man, and Cybernetics, IEEE, 2013.
8. RituGarg, Awadhesh Kumar Singh, "Adaptive workflow scheduling in grid computing based on dynamic resource availability", Engineering Science and Technology, an International Journal, 2015, pp. 1-14.

9. S. VaaheedhaKfatheen, A. Marimuthu, “ETS: An Efficient Task Scheduling Algorithm for Grid Computing”, Advances in Computational Sciences and Technology, Volume 10, Number 10, 2017, pp. 2911-2925.
10. Seyyed Mojtaba Ahmadi, Behrooz Masoumi, Reza Pourshaikh, "Resource Allocation in Grid Systems Using Collective Case-Based Reasoning Methods And Learning Automata”, IEEE, 2013.
11. ShashiBhushanSemwal, Amit Das, “Effective Time and Cost Based Task Scheduling In Grid Computing”, International Journal of Computer Science Trends and Technology (IJCST) – Volume 3 Issue 5, Sep-Oct 2015, pp. 118-122.
12. Shiv Prakash, DeoPrakashVidyarthi, “A Hybrid GABFO Scheduling for Optimal Makespan in Computational Grid”, International Journal of Applied Evolutionary Computation, Volume 5, Issue 3, 2014, pp. 57-83.
13. Syed NasirMehmood Shah, Ahmad Kamil Bin Mahmood, and Alan Oxley, "Hybrid Resource Allocation Method for Grid Computing", Second International Conference on Computer Research and Development, IEEE, 2010.
14. Vahe Aghazarian, Arash Ghorbannia, Nima GhazanfariMotlagh, Mohsen Khajeh Naeini, "RQSG-I: An Optimized Real-time Scheduling Algorithm for Tasks Allocation inGrid Environments”, IEEE, 2011.
15. Victor Toporkov, Dmitry Yemelyanov, Alexander Bobchenkov, PetrPotekhin, “Fair Resource Allocation and Metascheduling in Grid with VO Stakeholders Preferences”, International Conference on Parallel Processing Workshops, IEEE, 2016.
16. Zahra Pooranian, Mohammad Shojafar, Jemal H. Abawajy, Ajith Abraham, “An efficient meta-heuristic algorithm for gridcomputing”, Journal of Comb Optim, Springer, 2013, pp.1-22.
17. Chandra Blessie E, P.Pradeep Kumar, “Empirical Evaluation of Grid Computing Emerged Resource Scheduling Algorithms”, International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 02, 2020.
18. Chandra Blessie E, P.Pradeep Kumar, “A Review on Resource Scheduling Algorithms and their Applications in Grid Computing”, Journal of Emerging Technologies and Innovative Research (JETIR), Volume 6, Issue 6, June 2019.