Comparative Study of Job Scheduling Algorithms in Grid Computing

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1 Introduction

The objective of grid computing is to facilitate, optimize and improve the usage of resources that are spatially placed to perform a large single task or a number of tasks with a common goal which would be difficult for a single machine. Grid computing aims to decentralize the administration of resources with varied potentials in speed, computing power to perform complicated scientific applications [1]. It scrutinizes certain parameters like availability, usage cost, capability and other quality of services to share, aggregate and select the resources. Grid scheduler manages the resources and is responsible for assigning suitable resources to the user applications [2].

Working of grid computing is simple. It is done with four basic steps: First user submits job to grid, second scheduler distributed the jobs as per user needs and resources condition, third Jobs are executed in resources and last result received by the user. In this paper, we have discussed various job scheduling algorithms and presented a comparative study on them.

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2 A Novel Algorithm for Fault-Tolerant Job Scheduling and Load Balancing in Grid Computing [ANAFTJSLBG] [3]

This research paper proposes an algorithm for scheduling of jobs in grid computing. Main goal of this paper is to arrive at job tasks that will deliver in minimal response time and optimal utilization of computing nodes. The various job scheduling algorithms. Job scheduling is needed to utilize resources effectively in different areas of science and technology.

Advantages

- Dynamic load balancing algorithm doesn't any processing time.
- Whenever a load imbalance is detected, they change system state, information, location and selection of a process.
- For reducing failures, they proposed two approaches (a) Active replication (b) Passive replication.

Disadvantages

- Complex scheduling will lead to greater load impact on the system.
- There is an overload in the nodes due to unpredictable job arrival.
- There is an issue of task allocation and load balancing for most of the grids.

3 A Flexible Frame Work for Fault Tolerance in the Grid [FFFTG] [4]

Failure detection plays an important role in Grid Execution. This paper focuses on Failure Detection Service and presents a fault tolerance mechanism.

Advantages

- It helps in detection of both task crashes and user-defined exceptions.
- It allows user to achieve failure recovery in a variety of ways depending on the requirements and constraints of the applications.

Disadvantages

- This focuses on integrating only one failure type independent fault tolerance technique.
- This model doesn't work well because it can support neither task-specific failure definition detection and handling nor diverse failure handling strategies.

4 Bio-Inspired Optimization Techniques for Job Scheduling in Grid Computing [BIOTJSG] [5]

In this paper, authors' experimentally prove their feasibility to various distributed and parallel computing optimization problems. The properties like scalability flexibility, etc., allows them to perform efficiently in dynamically changing computing environments.

Advantages

- It can provide solutions for large-scale computer demands.
- It is more effective for computing optimization problem.

Disadvantages

- The cost is high.
- The process of scheduling is difficult.

5 Scheduling Jobs on Grid Computing Using Firefly Algorithm [SJGUFA] [6]

This paper presents an algorithm of job scheduling with a concept of firefly algorithm. Author nicely presented the algorithm. This new concept creates schedule in such a way the jobs can complete in minimum makespan.

Advantages

- This model handles several NP complete problems.
- This model has optimal schedule to finish the submitted job.
- This is proven to be a good search technique on continuous optimization.
- This model has lowest make-span time compared to max-min and min-min.

Disadvantages

- This method doesn't work properly for more number of jobs.
- Works good for those whose light intensity is good.

6 Incremental Checkpoint Based Failure Aware Scheduling Algorithm [ICBFASA] [7]

In grid computing, performance as well as failure factors both are important. In this environment, jobs are executed parallel so there is a need for failure-aware algorithm. Resource should not have high failure rate. Proposed algorithm considered failure factors as well as performance factors.

Advantages

- In this model, failure rate is reduced.
- The work is equally shared by all the nodes, so all nodes work simultaneously.
- Whenever a system fails is restart from the beginning which is waste of time, but in this model, it starts from where it has been stopped.
- Improved in performance ratio, failure ratio, success ratio and response time.

Disadvantages

- As it is having two copies of task, i.e. primary copy and backup copy memory consumption are high.

7 Fast PGA Based Scheduling of Dependent Tasks in Grid Computing to Provide QOS to Grid Users [FPBSDTGPQG] [8]

The fast PGA based proposed a method that covers various objectives. In this, overall execution time of jobs is minimum. Author also considered the deadline as well as budget factor. The task dependency among grid workflows is devised in DAG form. The input files are generated in standard task graph (STG) set. The implementation of proposed scheduling mechanism is done in ALEA3.0 grid scheduling simulator.

Advantages

- Many tasks are scheduled on one resource (cluster).
- One time slot is used for scheduling of each job.
- Heterogeneous resources are available to plan the schedule.

Disadvantages

- The cost of the entire system is high.
- Scheduling in such environment is crucial task.

8 An Adaptive Grouping Based Job Scheduling in Grid Computing [AAGBJSG] [9]

In this paper, author introduced job scheduling model in grid computing environments. A dynamic scheduling algorithm is proposed to maximize the resource utilization and minimize the processing time of the jobs. The proposed algorithm reduces the processing time of jobs.

Advantages

- It minimized the task communication time.
- Minimum Processing time.
- Dynamic resource characteristics are considered.
- It uses the resources sufficiently.
- Time complexity is high.
- It pays attention to network bandwidth and memory size.

Disadvantages

- The specific set of jobs that require only a specific set of resources.

9 Task Scheduling in Grid Computing Using Genetic Algorithm [TSGCGA] [10]

This paper focuses on genetic algorithms. This paper provides optimal solution.

Advantages

- It provides the optimal solution.
- Each task is taken into consideration.

Disadvantages

- It does not perform multiple tasks at the same time.

10 Grid Load Balancing Using ANT Colony Optimization [GLGBJSG] [11]

This paper proposed a technique that is based on ANT colony optimization. Load balancing plays a very important role in grid computing. This paper utilizes resources efficiently. Balanced load and takes less time for processing jobs.

Advantages

- It provides dynamic load balancing.
- It provides effective load balancing.

Disadvantages

- Ant can move only in one direction, it can't rollback (Table 1).

Table 1 Comparison of different jobs and resource scheduling algorithm

PAPER	RES.TI	RESO.UTI	LO.BL	COST
ANAFTJSLBG	LOW	HIGH	HIGH	HIGH
FFFTG	HIGH	LOW	LOW	HIGH
BIOTJSG	HIGH	HIGH	HIGH	HIGH
SJGUFA	LOW	HIGH	HIGH	HIGH
ICBFASA	LOW	HIGH	LOW	LOW
FPBSDTGPQG	LOW	HIGH	HIGH	HIGH
AAGBJSG	LOW	HIGH	HIGH	HIGH
TSGCGA	LOW	HIGH	HIGH	LOW
GLGBJSG	HIGH	HIGH	HIGH	HIGH

RES.TI response time, *RESO. UTI* resource utilization, *LO.BL* load balance

Comparative Study

We made an analysis of various papers. In Which ANAFTJSLBG paper is having low response time but efficiently utilizes resources. In FFFTG processing cost is high as well as low resource utilization but the response time is good.

BIOTJSG gives high response time and higher processing cost but good resource utilization and load balancing.

SJGUFA provides good load balancing and efficiently utilizes resources but processing cost is high. In ICBFASA, resource utilization is high but low in response time, load balance and processing cost. FPBSDTGPQG is high in resource utilization, load balancing and processing cost but low in response time. AAGBJSG gives good resource utilization but low in response time, load balance and processing cost. TSGCGA gives high response time and load balancing but processing cost is low and response time is also low.

11 Conclusion

Here we have made comparison of different algorithms using their response time, resource utilization, load balance and cost. In future, we will develop an algorithm which has high resource utilization and low cost processing.

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