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Game Theory Based Multi-Objective Resource Scheduling of Bag-of-Tasks Workflows on Cloud Environment

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Abstract

During 21st century of Engineering and Technology, Internet-based service and performance computation is playing a significant role in cyber world and physical world. It was perceived that computing paradigm meet the challenges of everyday needs of human community. The present scenario demands cloud computing, the latest computing paradigm basically steps on form of demand computing, pay-as-you-use on-demand basis. In this paper, we addresses Multi-objective Resource scheduling(MORS) and optimizing resources employing with Game Theory in order to achieve high resource utilization and users meet their work performance need with Low cost as well as Low Convergence Rate. Then we present cloud Environment in order to allocate resources by using Multi-Objective Resource Scheduling (MORS) for employed game theory. Cloud computing is the largest and latest distributed-paradigm where it has a tremendous impact & opportunities on the distributing systems of cloud computing techniques in order to solve large scale scientific problems. Hence, Game Theory Based Multi-objective Resource scheduling as well as the rules of elasticity in heterogenic of the computing resources has to be discussed in this proposed thesis. By taking two variables such as an independent variable and dependent variable, the first variable contains the Bags-of- Tasks (BoTs) of various resources and the second variable also analysing about the mode of work flow with a hedonistic sprit. However, we are trying to our level best to justify the invited article which has to be represented a generic model of heuristic scheduling algorithms with multi-objectives of Game-theory and cloud computing in order to scheduling its problems in the present scenario of the real world optimization, characterized by a number of Con-current Bags-Of –Tasks (CBoTs) i.e. Homogeneous which are the

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main sources of bottle neck and open great potential for Heterogeneous Workflow Optimization (HWO).
Key Words: Cloud Computing (CC), Multi Objective Resource Scheduling (MORS), Con-Current Bags of Task (CBoTs), Heterogeneous Workflow Optimization (HWO), Game Theory.

1. Introduction

At present Era Cloud Computing (CC) become very popular in the field of computing paradigm especially it has emerged a promising approach in Modern sector of Information Technology. Thus most of Companies has adopting Cloud Computing Environment for Software, Platform, and Infrastructure Development by which it can facilitate massive capacities of Intra-infrastructural investment in Business for getting optimum benefit in Micro-Small-Medium Enterprises (MSME) **[1]**. Where the Cloud Computing has refers a particular benefit to small and medium Enterprises or Business. Where as an Entrepreneur wish to complete outsource the avail data regarding the infrastructure development.

In the titled article, "Game Theory Based Multi-Objective Resource Scheduling of Bag-of-Tasks Workflows in Cloud Environment" has caught the attention not only the IT industry but academia as well. In this study we have analysed the entire research work in to some categorized way i.e. (A) "Bag-of-Task (BoT)" which contains many independent Tasks. (B) "Work Flows". Where, the tasks are interconnected though dependencies. Hence fourth this thesis has addresses the above said title which scheduling problems of large scale applications inspired .from real world, characterized by a huge number of Con-current Bags of Task (CBoT**) [2]** that are the main sources of this research work and it has the bottle necks with opening a great potential for Heterogeneous Workflow Optimization (HWO) **[3]**. Finally, The multiple scheduling problems are formulated as a new sequential of co-operative games and purposes a communication through scheduling optimization of Multi-objective Resource Scheduling (MORS) **[4]** and its algorithm that optimizes many user objectives such as minimize the execution time, economic cost (e.g., time, cost) while fulfilling other constraints, as per the system prospective provides a system-level efficiency and quality of service (QoS) **[5]** to all users. Henceforth, we have keen interest to do our research work on this proposed area, where most of the hybrid heuristic-based scheduling algorithms that to be employed many heuristics models. Thus, the basic idea of this thesis has proposed a number of algorithms such as Simulated Annealing (SA), Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), and Hyper-Heuristic Scheduling Algorithm (HHSA) **[6]**.

The major advantages of our Game Theory Based Multi-objective Resource Scheduling as compared to other heuristics algorithms are its faster convergence as well as low cost to determine the search directions, movements, storage requirements regarding the problem formulation and easy to customize new objectives.

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2. Literature Review

In literature review, we have taken two variables like independent variable and dependent variable with followed by number of constraints where independent variables consist the concurrent Bag of Tasks (CBoTs) [7] consists of many independent tasks such as machines of two companies like TATA and Ashok Leyland Ltd. here the machines are independently operated by a fixed time schedule specific date and allocated of resources such as the expert skills of pilots technical knowledge with budget.

2.2 Work Flows

In this article, we have decided to take many heterogeneous work assignments or jobs for evaluation of work performance of three pilots in homogeneous power of machines Such as minimize the make span, cost money, distance, storage etc. are often conflicting because it deals with non-dominated solution or pareto-optimal (2000 Hertz Power) where the pilot shows their expert skill of by operating machines technically but we have cross over and mutation of machines work performance on various job assignments in order to testing the heterogeneous work flow[8] performance .If the assigned work is heterogeneous the performance of machines in heterogeneous work are not optimum but if there the constraints are favourable then it has accelerate the work flow for a maximum optimization.

2.3 Multi-Objective Scheduling:

Multi-objective scheduling [9] minimizes the expected execution time and cost of application in real world problems simultaneously optimize multiple objectives

solution That means one objective shows up gradation result where as other one shows degradation result. Instead of getting a single optimal solution with respect to one another

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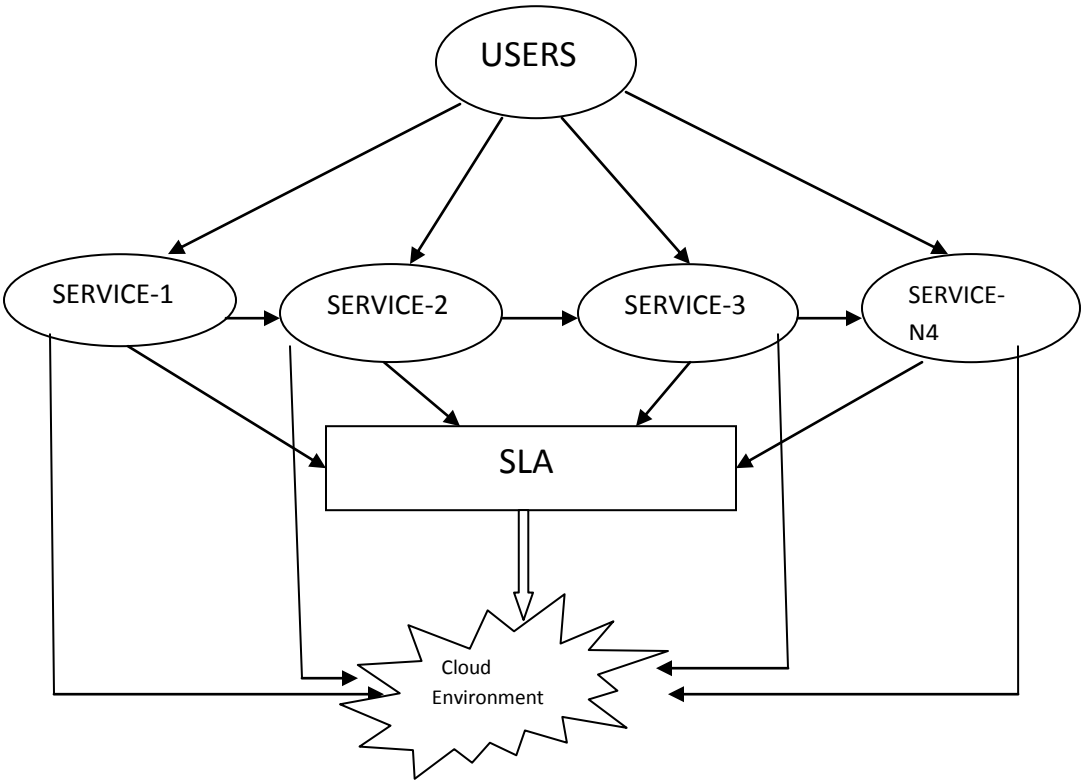
Models of Cloud Computing System: [Figure: 1]



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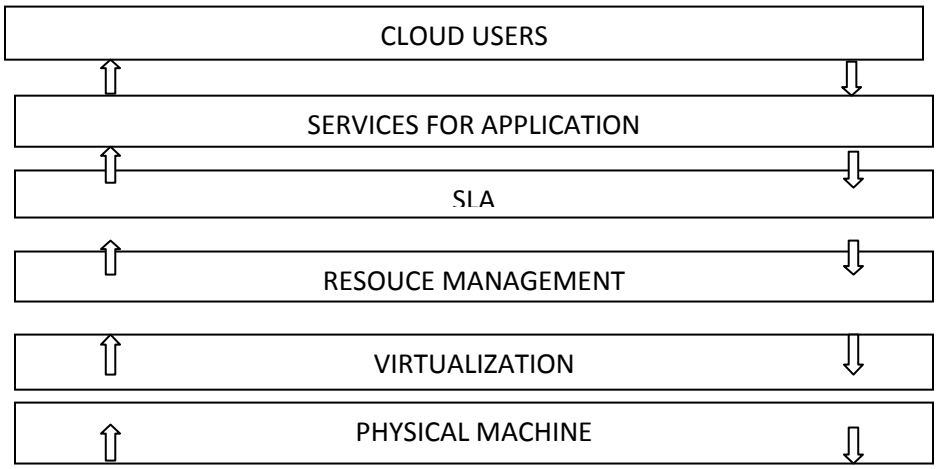

Figure.2: Layered Architecture

2.4Concept of Pareto dominance:

One objective, multi-objective aim is to getting the pareto-optimal solution. In case of Single objective, one attempt to obtain the best solution whereas in case of multi-objective, one cannot identify a single Solution that simultaneously optimizes each objective. Finally when attempting to improve one objective, other objective suffer as a result.

Suppose to consider problem maximization & its solution. Let x, y be two decision vectors (solutions) from the definition domain.

Solution x dominate y (also written as x f y) if and only if the following conditions are fulfilled:

(i) fi (x) ≥ fi(y); ∀i = 1, 2, n;

(ii) ∃ j∈ {1, 2… n}: fi(x) > fi(y). ---------- [11]

That is, a feasible vector x is Pareto optimal if no feasible vector y can increase some criterion without causing a simultaneous decrease in at least one other criterion. Multi objective evolutionary algorithms can yield a whole set of potential solutions, which are all optimal in some sense. The main challenge in a multi objective optimization environment is to minimize the distance of the generated solutions to the Pareto set and to maximize the diversity of the developed Pareto set. A good Pareto set may be obtained by appropriate guiding of the search process through careful design of reproduction operators and fitness assignment strategies. To obtain diversification special care has to be taken in the selection process. Here, a special care has to be taken care in order to prevent a non- problematic loss of

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economical cost and slow convergence rate.**2.4.1Solution Representation and Genetic Operators**

In the proposed multi objective approach, the solution is represented as a string of equal length to the number of jobs. The values corresponding to each position i.e. in the string represent the machine to which job that was allocated.

Consider we have 10 jobs and 3 machines. Then a chromosome and the job Scheduling can be represented as follows:

Table-1.

1	2	3	2	1	1	3	2	1	3
Machine 1	**Job 1**	**Job 5**			**Job 6**			**Job 9**	
Machine 2	**Job 2**	**Job 4**			**Job8**				
Machine 3	**Job 3**	**Job 7**			**Job.7**				

Mutation and crossover were used as operators. Binary tournament selection was used in the implementation. The Pareto dominance concept is used in order to compare 2 solutions. The one which dominates is preferred. In case of non dominance, the solution whose jobs allocation between machines is uniform is preferred. This means, there will not be idle machines as well as overloaded machines. The evolution process is similar to the evolution scheme of a standard genetic algorithm for multi objective resource scheduling optimization.

2.5 Experimental Results

As a preliminary study, two sets of scheduling experiments were performed. Results obtained by MOEA are compared with a simple Genetic algorithm (GA), Simulated Annealing (SA) and Particle Swarm Optimization (PSO) [12]. Specific parameter settings for all the considered algorithms are described in

Each experiment was repeated 10 times with different random seeds. Each trial (except for MOEA) had a fixed number of 50 ∗m∗n iterations (m is the number of the grid nodes, n is the number of the jobs). The makes pan values of the best solutions throughout the optimization run were recorded. In a grid environment, the main emphasis was to generate the schedules as fast as possible. So the completion time for 10 trials was used as one of the criteria to improve their performance. First we tested a small scale job scheduling problem involving 3 nodes and 13 jobs represented as (3, 13). The node speeds of the 3 nodes are 4, 3, 2 CPUT, and the job length of 13 jobs are

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6,12,16,20,24,28,30,36,40,42,48,52,60 cycles, respectively. The results (makes pan) for 10 runs were as follows:

• GA: {47, 46, 47, 47.3333, 46, 47, 47, 47, 47.3333, 49}, average value = 47.1167.

• SA: {46.5, 46.5, 46, 46, 46, 46.6667, 47, 47.3333, 47, 47} average value = 46.6.

• PSO: {46, 46, 46, 46, 46.5, 46.5, 46.5, 46, 46.5, 46.6667}, average value = 46.2667.

Table: 1 Heuristics Algorithms

Algorithm	Parameter	Value
GA	Population size Crossover probability Mutation probability Scale for mutations	20 0.8 0.02 0.1
SA	Number operations before temperature adjustment Number of cycles SA temperature reduction factor Vector for control step of length adjustment Initial temperature	20 10 0.85 2 50
PSO	Swarm size PSO Self-recognition coefficient c1 1.49 Social coefficient c2 1.49 Inertia weight w	20 1.49 1.49 0.9 → 0.1
MOEA	Population size Number of generations Mutation probability Crossover probability	100 (500 for the second experiment) 200 (1000 for the second experiment) 1 (0.9 for the second experiment) 1 (0.9 for the second experiment)

•MOEA: {46, 46, 46, 46, 46, 46, 46, 46, 46, 46}, average value = 46.

The optimal result for (3, 13) makes pan is supposed to be 46 and the MOEA approach gave 46. The average total flow time obtained = 138. While GA provided the best results twice, SA and PSO provided the best result three and five times respectively. MOEA approach is obtaining the best result in each of the considered runs.

Further, we tested the algorithms for the case (10, 50). All the jobs and the nodes were submitted at one time. The average makes pan values for 10 trials are illustrated in Table 2. Although the average makes pan value of SA was better than that of GA for (3, 13), the case was reversed for this second case. Using the MOEA approach, the total average flow time obtained is = 348.07. Figures 1 (a) and (b) illustrate the makes pan and flow time given by 31 non-dominated solutions from the final population. The user

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would have the option to go for a better flow time solution at the expense of a non-optimal makes pan. As evident from the Figure, the lowest flow time was 343.72 with the makes pan of 44.75 for solution no. 27.

Table: 2. Performance Comparison for the case (10, 50).

Algorithm	Average Makes Pan
GA	**38.04**
SA	**41.78**
PSO	**37.66**
MOEA	**36.68**

Results obtained by GA, SA and PSO were adapted from [1]. As evident from the data obtained above, MOEA have given excellent results when compared to other techniques modelled using a single objective approach. Due to space limitations, more results (also Pareto fronts etc.) could not be presented in this paper.

2.6 Game Theory

Game theory [13] is a mathematical study of strategy which attempts to determine the interaction among all game players to ensure the best outcome for themselves. A game consist of three factors such as a set of players, all the possible strategies each player will choose the specified utilities of players associate with the strategy perform by the every player. At each step, players choose one of there strategies and get a utility in return, each player of game tries to maximize its own utility by choosing the most profitable strategy against other player choices. Nash equilibrium is a central notion of game theory which means in this situation no player can get more utilities by changing its strategy.

The main purpose of implementing Game Theory Based Multi-objective Resource Scheduling [14] is that my previous author has been adopted performance -oriented models of distributing computing on various system levels of load balancing, resource allocation etc. in order to introduce game theory aspects in to computation questions. But we focused on various service providers how providing their services on various products to the customers in order to facilitating the performance of technical experts of allocated machines of two companies for high computational rate of work flow optimization.

3. Scope of the work

3.1. Motivation

- To maintain the flexibility in between the variability by which it ensure resource –intensive process shall be well utilized.
- It focuses & enables to construct IT infrastructure in various sector.
- It enables quick scale of IT operation in new computing resources.

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- It focuses and consumes economical benefits to the service provider as well as the consumer by implementing IT cloud computing in various variables.

- It improves cloud computing techniques more scientifically to use for enhancing inherited resiliency.

- It is highly automated to implement in IT structure with high quality of service provide to the customer.

- To reduce the high computational cost due to their slow convergence rate for the effective utilization of global resource information

3.2 Objectives:

The main Objectives of the thesis, it has designed in a new way of algorithm for scheduling a set of multi–objectives of game theory application which will be analyzed with consists of a large number of Principles (Existing algorithm which aren't scale) in an environment modelled. In this research work our algorithm aims at number of objectives and its functions which are related with this title that.

(i) To be testing the generic performance of cloud computing system on multi-objective resource scheduling.

(ii) To be compared the main advantages and disadvantages of evolutionary algorithm whether they high computational cost due to their slowly convergence rate [15].

(iii) To know about the hybrid cloud Multi scheduling algorithm (HCMSA) impact on game theory.

(iv)To be observed the consumer's perception style towards the products consumption and its elasticity.

(V) To facilitate the work flow sprit among the minds of employees in order to enhancing their work performance from lower stage to higher stage.

(vi)To justify the role of Cloud -Sims and Hadoop in multi-objective resource scheduling as subject to the game theory practice.

(vii) To study the significance of the taken variables with comparison total quality management (TQM).

4. Models

As the models of game theory based multi-objective resource scheduling of resource allocation as concerned, we have already discussed and described in the abstract section about various models how to be applied in order to know the performance of system administration of an organization for a better communication and choice of location. Where, allocation of resources for an operational function of workflows of cloud computing environment by assignment of the number of tasks work flow performance provided by the service providers like Google and Amazon in order

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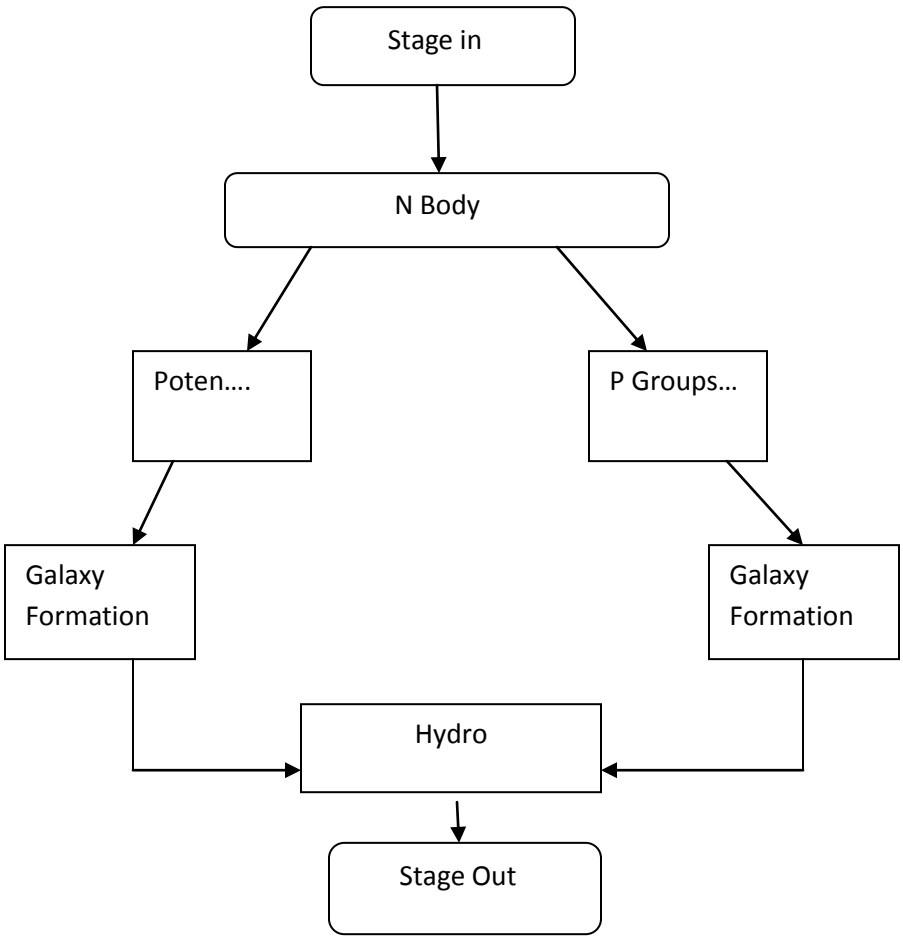
to facilitates the cloud services of an organization for selecting a suitable location for creating a good cloud computing environment. Here ,we have decided to allocate time as the factor of communication and place as the factor of location for mobilizing the availed resources with communication of service, and location of task i.e. make span , minimizing cost, time, performance and other constraints in order to justify the validity of resource allocation and its scheduling. Here, we have taken number of models for the real application of the real world of cloud computing Environment.

Figure.3.Real-world Application Model



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4.0 Work flow Application Model:

Primarily, we are concentrating on the large-scale workflows characterized by a high number of homogeneous parallel (independent) tasks of two service providers such as Google and Amazon where, we have taken bag- of -tasks as an independent variables in order to test the performance of cloud services are to be observed through the less execution of time with low cost that interconnected through control and data flow dependencies.

4.2 Problem Definition

Let W=(BS, DD) where BS stands for Bag-of-Tasks(BoTs) and DD denotes the work flow application model as DAG, where BS= $\cup_{k=1}^{K} T_K$ is the set of constraints (K) i.e. Heterogeneous of Bag of Tasks and DD= (T_s<d , $|T_d\{T_s, T_d\}$ C BS) where the set of work flow dependencies data are related with the performance due to its dependencies on number of constraints, therefore we call T_s the predecessor of T_d and write: T_s=Pred (T_d) .

TABLE: 3

Amazon Cloud versus Google Cloud

(Prices as of December 1, 2012)

Service Provider	Virtual Cores	Memory (GB)	Compute Unit	HDD (GB)	$ Per Hours	$ Per Unit Per Hours
Google	1	3.75	2.75	420	0.145	0.053
Amazon	1	3.75	2	410	0.160	0.080
Google	2	7.5	5.5	870	0.290	0.053
Amazon	2	7.5	4	850	0.320	0.080
Google	4	15	11	1770	0.580	0.053
Amazon	4	15	8	1690	0.640	0.080
Google	8	30	22	3540	1.160	0.053
Amazon	8	30	20	3410	0.900	0.069
Google	8	34.2	13	1690	0.660	0.033

Where T_s = Time schedule and T_d=Time Deviation.

We define a Bag of Tasks(BoTs)is an independent variable by taking machines of two companies with equal power as a homogeneous which is functioned or operated

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as parallel form sequential task i.e. 1 2 3 and descending order 3 2 1 and crossover 3 1 2, 1 3 2, 2 1 3 with completely mutation and random order.

Therefore, the sequential task T_k=$\bigcup_{j=1}^{K_k} T_{kj}$, k ∈ [1, 2 …K]. That have the same type of task can be concurrently executed where K_k is the cardinality of Bag of Tasks (BoTs).

4.3 Problem Formulation

As predicated to problem formulation we have analyzed a number of application in the definition paragraph i.e. problem definition where the task is completely independent (Service Provider) but ignoring about the service operating time which consists of number of task that can be categorized into *K* in different job activities(BoTs) and a cloud environment consists of *S* sites. Therefore the make span of an application isA_i, i ∈ [1, n] is the maximum completion time of its BoTs. Hence, the objective of multi-objective scheduling problem is to find a solution that assigns all tasks to the Cloud Service (Through Service Provider) of two Service Provider Companies such as Google and Amazon ,in order to test the work flow performance of services for low convergence rate of workflow with optimizing performance. Thus we expect that the minimization of cost expenses for the resource allocation and hopes for an optimization of work performance of Services.

Henceforth, the make span and the economic cost of all applications F(s) are minimized and the workflow activities are optimized and fulfilled.

Minimize$_s$ $F(s)$= *(P(s), E(s)),*

S.t. V(s)$\leq \tau s, i \in [1, S]$,

(1)

$M(s) \leq \tau s, i \in [1, S]$,

$s \in F(s)$,

Where s is a solution and F(s) is the feasible solution and F(s) is the image of s, The performance of service provider P(s), Economic cost of objective E(s), Variation of Time V(s), and Variation Cost (Tk_i), $\tau s, i \in [1, S]$is the recorded data for evaluation of work flow performance (W_i) and consumption of time (T_i) for testing and observing different work activities related to time as limit (24 hours per day) on each *S* sites.

In connection with we expect that the availability of time in order to observe the work performances of machines as related with bag of task (BoTs). Hence forth, we decide to implement algorithm principle as well as matrix formula for smooth calculation of time factor in order to deliver the expected proper execution of time (PET) of task in each BoTs K∈1, K on each S site $\tau s, i \in [1, S]$.

In addition to that other related constraints like cost, pilot expert, make span, performance, plays vital role in order to enhancing work performance of machine besides that communication also a vital factor for assembling the recourses in order to execute properly. Hence forth, the performance of

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machines in heterogeneous assignments related with BoTs.

For testing cloud computing environment of work performance we have applied many application in many cases where as multi-objective resource scheduling and game theory are the most important factor for consideration for example for large scale application it is necessary to use multi objective resource scheduling and BoTs for smooth function of machine beyond this or overlap, resulting in the execution time determined as highly convergence as well as expensive therefore we may define the execution time(E_{ki}) (24 hours per day is maximum and 8 hours per day is minimum) is necessary for computation time C_{ki} and workflow performance Wp_{ki} as follows:

$$E_{ki} = \begin{cases} C_{ki} & C_{ki} \geq Wp_{ki} \\ C_{ki} + (Wp_{ki} - C_{ki}) = Wp_{ki} & C_{ki} < Wp_{ki} \end{cases} \quad (2)$$

Where Wp_{ki} can be expressed as

$$Wp_{ki} = \frac{D_{ki}}{M_{ki}}, \quad (3)$$

Where D_{ki} = data size of the task M_{ki} = Service allocated to BoTs on site S_i .

Based on the above analysis, we can find that for data-intensive applications, the expected execution time E_{ki} is determined by either computation time or workflow performance.

4.4 Game Theoretic Solution:

As the multi objective scheduling of resource allocation as concerned we have taken the number of constraints for problem formulation and its solution in order to obtaining the research objectives or goals .Thus, we are decided to take Game Theory as the one factor of constraints to justify the role of Bag-of-Tasks (BoTs) on the process of Game Theory by which a problem can be easily formulated with playing a cooperative game among the application of Cloud services and efficiency of service providers which can theoretically generate the optimum solution of its application which is hard to achieve due to facing number of problems at different levels of work assignment again this problem is seems highly complexity to do the performance effectively at different hedonistic condition such as System failure , failure of WEB links (Network failure) Untrained Service Operator (USO), inefficiency of data transmission, lack of technical knowledge of service agents, fatigues' of the Service Agent(FSA) and required budget or cost etc. Therefore, we observed that the problems can be further formulated and addresses as sequential for playing the co-operative game. While we playing it we require to redefine of five parameters like Cloud Service Provider, Expert of Service Operator (Agent), Service planning and strategies, specification of time and required budget.

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1. Cloud Service Provider:

The first parameter we have taken two different service provider companies Google & Amazon, in order to observe their work performance followed by game theory application of operational efficiency of service provider and their attempts to minimize the execution of time (E_{ki}) and cost (Tk_i) of one Bag-of-Tasks on the basis of total number of tasks (Sk_i) and its processing rate of work flow performance (βWp_{ki}) on each site S_i. For a better work performance and clarity of work we have assumed and taken a manager and three pilots for application of their efficiency on the real field of work environment in order to handle and execution of one by one Bag-of-Tasks through the application of game theory by use of Algorithm method.

Therefore, the objectives of service Provider and each Service Operators (Agent) are to minimize the execution of time and economic cost of its BoT while function of the constraints of work assignment and expressed as:

2. Expert skill of Service Operator (ESO)

The second parameter, we have taken the Expertization of Service Operator (ESO) where the Service Operator's expert skill plays an important role for adequate service providing to the cloud users. Here, the expert skill refers to the quality or skill of an operator whose are timely done their assigned task perfectly and efficiently by which they able to provide the services to their clients in timely and accurately.

3. Service planning and Strategies:

In the parameter, we have taken an account in to consideration that service planning & strategy of cloud service provider , where planning means , thoughts or ideas (Generic) of a service operator how will be execute in a systematic way or process. Here, the Service Operators (SO) is going to prepare some of plans, game plans (Strategic) in order to execute the plans, prepared by them previously for the purpose of providing a well and adequate service facility to their esteemed service users... This plans are to be execute through the game theoretic way of playing, by which the planning and strategies are to be optimum success as per their expectation

4. Specification of Time

In the fourth parameter we have taken specific time 16 hours per day to each pilot as a constraint which can be redefined.

5. Required Budget

As per the constraint it needs a specific budget and its allocation with mobilization of funds in order to meet the requirements of the assigned work as well as the project title. To further compare the quality of the GMO solution against the absolute optimum, we consider a small-sized problem consisting of two sites with three and two homogeneous processors each and two BoTs containing five tasks each. We use in our simulation both consistent matrices and inconsistent matrices, outlined in Table 2: consistent represents that, if a site A

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executes a task .faster and more expensive than site B, then A executes all tasks faster and more expensive than B, while inconsistent characterizes the situation when the site A might be faster and more expensive than B for some tasks and slower and less expensive for some other constraints. However others algorithms require more scheduling time to execute for such type of large problems

Table: 4

Processor	T1	T2	GMO	G-Min-Min	G-Max-Min
S1: P1	15	9	9, 9	9, 15	15, 9
S1:P2	15	9	9, 9	9, 15	15, 9
S1:P3	10	8	10, 10	8, 10	10, 8
S2:P1	10	8	10, 10	8, 10	10, 8
S2:P2	10	8	10, 9	8, 10	10, 8
Make span			19	23	23

4.5 Rationality of Game Theory in Cloud Computing Services in probabilistic Mode of Play:

As per the availed data from the field, we developed an experiment on the work performance of three JCB machines such 1, 2, 3, with randomly mutation rather than chronological set. This game has played by three experienced Pilots and it does not beyond three pilot games because if do empirical theories you have remain closed the data ,most games (Machines of JCB) played by three pilots not more than four and five pilot piloting machines (JCB) experimental. The parameter space is enormous; one is hesitant to generalize beyond the three pilots. Thus the virtualized three pilots operating machines is only for Zero" normalized games for games which have minimum time needs with maximum work performance and minimizes the economic cost. We think every thing changes if the pilot has positive effort & coalitions. We had already played more than 200 games of JCB Machines piloting.

Normative &Descriptive Theory of Probability:

By implementing the descriptive theory, we aimed at bounded rational behaviour of pilots, by observing from their field experiments of (Piloting JCB's) & emerged. Theorizing has no longer based on the idea of fully rationally, but rather than the stipulated time and budget. Thus we, show you a comparison for a very simple job of assignment i.e.

4.6 The Normative & descriptive Theory of Probability:

In this experiment of this game theory, we want to consider all work performance of three pilots by using a quota game, without Grand coalition and minimum payoff for one pilot's coalition. Let us, see the triangle 1.of above where you can look at the three players (Pilots) like 1,2,3, where, 1 and 2 together done the job 'A' and 1,and 3 together done the

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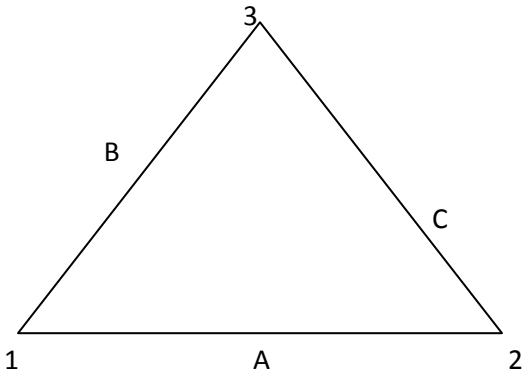
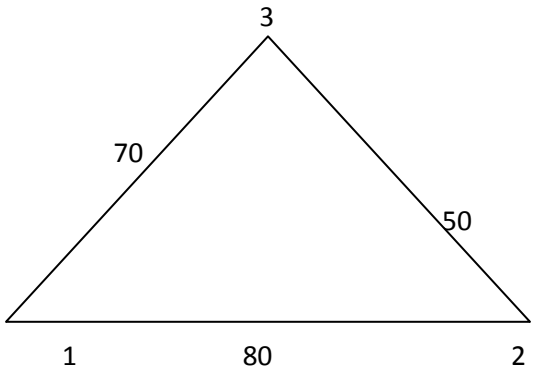
job 'B' and 3,and 2 together done the job 'C'. Thus, B & C is greater than 'A'. In this way the pilots just did their assigned jobs.

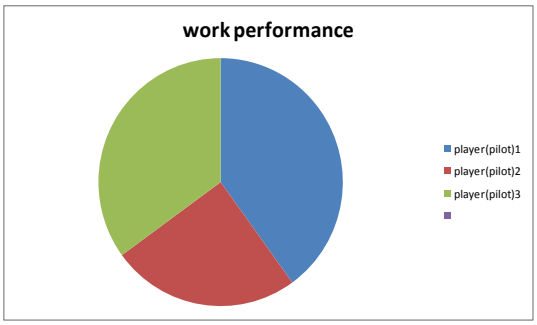


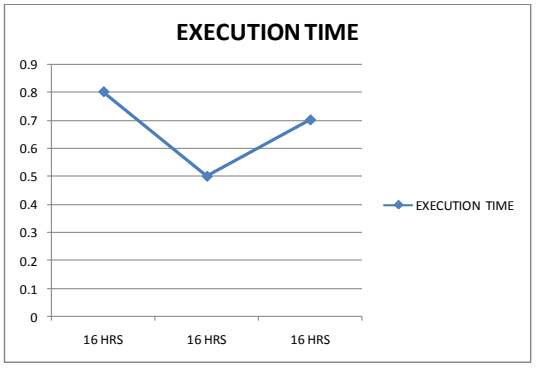
NB: In this diagram represents A >B>C= 0

A+B> C, B+C >A

[Triangular Model of Quota Theory of Games]







[**Work performance of Three Pilots by Execution of Time**]

An example of fully symmetric 3 pilot's quota games without grand coalition and three minimums cost pay of to one pilot coalition .The obtained values are all together than or equal to "zero' and then 'B' plus 'C' is greater than 'A'. This is a kind of triangular equation, we are experimented 200 games, where, pilots get 80.70 and 50 respectively games.

5.1 Results of Semiotic Model by using pie chart:

This semiotic models of pie chart focuses about the work flow performance of three JCB machines operating by the three pilots in

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different time as per the stipulated time (16) hours per day.

4.7 Solution by using Quota Theory:

In order to solute, this problem, earlier we have taken game theory of algorithm, and here, we have taken three quotas of assignment of piloting such as q1, q2, and q3 in order to define the concepts of minimizing cost of expenditure and time as well as maximizing work flow of performance of pilots (over JCB machines) by the way the three pilots i.e. 1, 2, and 3, with the property of that quotas of two pilots. Sum the value of their coalition. So the sum of q_1, q_2 is sum of 'A' q_1 and q_1 and q_3 is the sum of 'B'q_2 and q_3 is the sum up 'C'.

'A' in order to testing the prevails pilot 1 can offer more two pilot '3' than pilot'2',here, only quota agreements avoid this kind of discrepancies and imbalanced in between them. [**Table: 5]**

Quotas/Assignments	**Equal division of cost Bounds**
q_1+q_2= A	1>2>3(order of strength)
q_2+q_3 =B	Lower bound S_1,S_2 and S_3 for payment.
q_2+q_3 =C	in to '2'pilots coalitions
Example: q_1=50	Stronger member can claim equal share S_1=A/2, S_2 =C/2
q_2=30 q_3=20	Upper bounds for 1and 2 in (1,2) H1= A-S_2, H2= a- S_1 3's competitive bound S_3=Max.S=40, s_2=25, s_3 =10
Circular definition	**An algorithm definition has proved.**

Research Findings:

In this research work, we got the following findings for the future course of research work of young researcher i.e.

- To facilitate and empowered the probabilistic theory of problem solution on cloud computing environment instead of algorithm way of problem solution .because the physical concept of work assignment is very much clear than the cloud service.
- To make balanced by using various method of cloud computing techniques if the discrepancies or imbalanced are occurs.
- To minimise the stipulated time of work assignment with work flow maximization in order to minimizes the cost of expenditure.
- To observe the discrepancies in between the variables of resource allocation, resource mobilization, transformation and make transparency in the work.

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It gives us immense pleasure to share some thing with the intellectual minds of the world .where we are highly thankful to them if this article gives them satisfaction as they desire to digest their related problems of research work of the current scenario of research work in the field of cloud computing environment.

In connection with firstly, we express our tribute and gratitude to the Almighty, Who bless us to think about the assigned research work of cloud computing environment, by the blessings of "God" we able to write some thing. Secondly we express our highly thankful to the dignitaries who are encouraged and motivated to complete the research work.ie our parents, teachers, friends, relatives, colleagues and our lovely students because of their inspirations are highly motivated to a great extent in order to complete this article.

Conclusion:

In conclusion, we may conclude that, "Game Theory Based Multi-Objective Resource Scheduling of Bag-of-Tasks Workflows on Cloud Environment" is an excellent version of research work, where many eminent researchers has presented their article regarding the said article before us on the basis of problematic solution by using algorithm .But in this research work ,we first time introduced and used the concept of game theory of multi objective scheduling of bags-of –tasks work flows on cloud computing environment and its problematic solution by using the probabilistic method in order to observe the discrepancies in between the assigned variable of bags-of tasks, and the workflows of cloud computing environment for the purpose of optimization of workflow with minimizing the allocated time. After the cross over, mutation, comparison, and testing with its authenticity we came to conclude, probabilistic way of game theory has a highly impactful than the algorithm based of computation.

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