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Service Request Approach for e-Governance using Federation of Cloud

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***Abstract*—** Job scheduling is one of the major task in the federated cloud computing environment. In this paper a method using the existing job sequencing with deadline algorithm is proposed. The presented model including the existing job sequencing with deadline algorithm, sequences the jobs according to the optimization criterion of minimum energy consumption by the data center server, with the constraint to complete the jobs within deadline. The study mainly emphasizes to develop a system that maximizes the utilization of computing resources on one hand, while on other hand provides proper load balancing and task scheduling to get the optimal solution in the cloud federation for e-Governance services.

***Keywords*—** Cloud computing, Job scheduling, Cloud federation, Cloud service broker.

I. INTRODUCTION

Cloud Computing is an emerging and innovative technology that provides the computing platform for sharing resources. Computing resources include H/W infrastructure, software, datacenters, database, applications, and business process. It is a model that shares data and computation over a scalable network of nodes. These nodes include end users, computers, data centers and cloud services [1].

According to National Institute of Standards and Technology, USA (NIST), "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [2].

As the e-Governance is a large project to provide more efficient, reliable services nationally and internationally so federation of clouds may be used. The federation of cloud provides specialized services - load balancing, high performance access, resource sharing and scalability. Cloud service providers are interconnected and follow the standard protocol to provide the optimized performance under agreed standards of quality of services. Governments have a large number of resources, hence federation of cloud[3][4] helps to utilize and share these resources efficiently and distribute the workload optimally at the time of high load and select the best cloud infrastructure that is required to run the e-Governance services. By using federation of cloud, the user gets the services by the best cloud service provider that optimizes the service –provisioning process in a way to provide efficient, cost effective service with assured quality of service to the users. Federated cloud reduces the IT infrastructure cost and provides highly scalable, location independent platform and intelligent infrastructure with the integration of advance framework that is compatible with cloud architecture. The federated cloud helps the government in analyzing the large amount of data and provides the mechanism to detect discrepancy, redundancy and enhance the security and reliability of data. Scheduling policy plays an important role for efficient utilization of resources and reduces power consumption. A good scheduling algorithm considers the priority of jobs and maximize throughput, minimize makespan time and execution time of the jobs, and enacts proper distribution of load and utilization of the resources, Thus it reduces the per user cost of the resources . For scheduling in the cloud computing environment, the Datacenter broker supervises all resources and collects their respective status regularly in the cloud. Based on the resource status, the cloud scheduler takes the decision regarding the jobs in the current queue to assign optimal resource to the scheduled jobs that are waiting in the queue [5]. The use of green ICT is increasing in e-Governance system that provides the environment friendly ICT devices that reduce the emission of carbon dioxide and preserve the energy.

II. RELATED WORK

In the cloud computing environment for e-Governance services load balancing and task scheduling play important role for facilitating effective, efficient and secure services to the end user. For enabling green computing, the constraint of being energy efficient is also added in this. There are a lot of researches in this field.

Ziqian Dong et al. [6] formulated and proposed a greedy task scheduling to reduce energy consumption of data centers. They compared and evaluated performance using Matlab simulation. According to their simulation result, the proposed MESF task scheduling method saves on average over 70 times as compared to a random-based task-scheduling scheme.

In 2015, Dr. M. Srivenkatesh and K.Vanitha[3] proposed Multilevel Queue Task Scheduling Algorithm based on, genetic algorithm for federated cloud.

Kyong Hoon Kim et al.[7] proposed power-aware scheduling algorithm for bag-of-tasks applications with deadline constraints on DVS-enabled clusters to minimize energy consumption by controlling appropriate voltage levels.

Cong Liu et al.[8] developed an algorithm PASS for tasks with different priorities and deadlines. PASS minimize the energy consumption and maximize the tasks completed before the deadline. They used the DVS techniques and reduced energy consumption by available slacks and appropriate adjusting voltage level. They compared the simulated results with CC-EDF and PASS saves up to 60% of energy dissipation.

Shruti et al.[9] illustrate a method with deadline & used an algorithm Deadline Aware Particle Swarm Optimization(DAPSO) and it is better than PSO algorithm. It has fast convergence property & optimizes the schedule task efficiently and profitably.

Indukuri R. Krishnam Raju et al.[10] proposed an algorithm Deadline Aware Two Stage Scheduling to schedule the requested customer's jobs. In the model, for the task completion each job requires two VMs in sequence. It allocates VM as resource to request job based on processing time & schedule the job by deadline. The simulation result is compared with FCFS and SJF scheduling algorithm.

Our proposed work focuses on the optimized job scheduling approach and load balancing for e-Governance services for providing efficient and quick services to the user with minimum energy consumption.

III. PROPOSED FRAMEWORK & METHODOLOGY

In the e-Governance model, all users send the service request to the central cloud server broker in first come first serve basis. Then the central cloud server broker sends the entire request to scheduler. Scheduler calculates the deadline and energy consumption of the each client task. Then the central cloud server broker distributes the task to cloud1, cloud2 and cloud3 according to the category of the jobs. The cloud1, cloud2, and cloud3 receive the jobs in first come first serve basis. Then each cloud applies the existing job sequencing with deadline algorithm[11] for the optimal sequencing according to minimum consumption of the energy under the constraint that each task should be completed within the deadline otherwise the defaulting tasks are rejected by the cloud scheduler. The user would submit such tasks again. The scheduler receives the entire batch of client tasks in optimal sequence and executes them. The client tasks which consume minimum energy and are completed within the deadline, have to be executed first. The requested data or information has to be sent to the appropriate user.

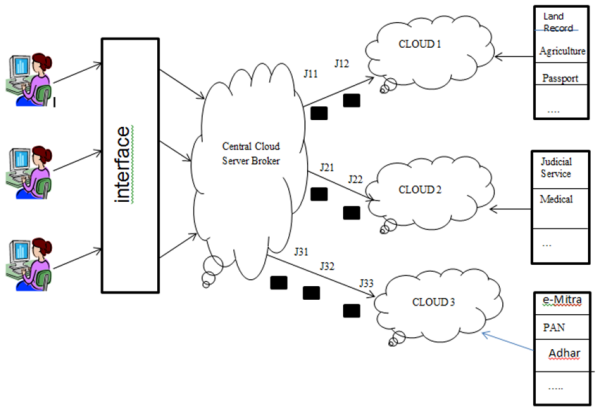

Figure: 1. Proposed framework model for scheduling in e-Governance

IV. PROPOSED TASK SCHEDULING APPROACH

In the proposed method user submits their jobs. The job schedulers of central cloud service broker calculates the energy consumption and deadline of each submitted job and distribute the jobs to the clouds providing the particular type of service as demanded by the user. For example, if the user requested for PAN Service then the central cloud service broker would assign this with the job number J32 by adding the deadline and energy consumption and transfer the job to cloud3 for service category 2. At the cloud3, the existing job sequencing algorithm with deadline [11] is executed to get the optimal sequencing of the jobs. Here the job scheduler receives the sequence of the optimal tasks and executes the client task and the user gets the desired information. The steps are

Step 1: Users submits the job request to the cloud.

Step 2: Central cloud service broker verifies the authentic submitted job request say i. Calculate the integer deadline (di) and energy consumption (Ei) where di >0 and Ei >0 and transfer the job to the cloud1, cloud2, cloud3 according to the service type.

Step 3: At cloud1, cloud2, cloud3 use the job sequencing with deadline algorithm [11] to arrange the jobs in sequence to get the optimal solution.

Step 4: Process the jobs within deadline and with minimum energy consumption. Assume that each job requires only one unit of time for its processing and reject the job which consumed more energy and does not process with in deadline. The value of the feasible solution is the sum of total energy consumption $\sum$ Ei of jobs in this model at every cloud. An optimal solution is the feasible solution with minimum energy consumption.

Step 5 : Finally the tasks are executed.

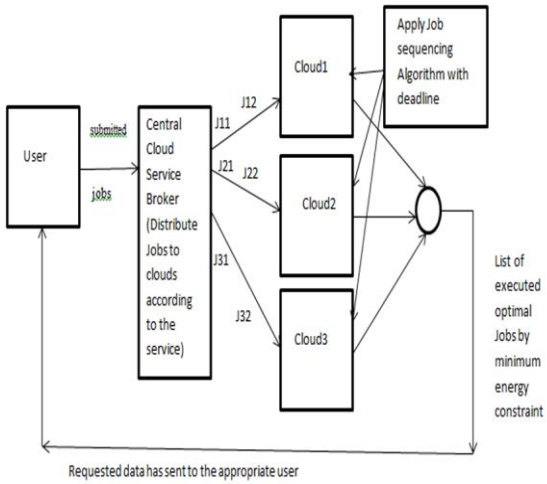

Figure: 2. Task scheduler model

[Figure-2] describe the job submission by the users and the job execution by the above system.

1. Job submission: A number of users, submits a number of jobs in the above system.

2. Central cloud service broker: It accepts all the jobs from the queue that is submitted by all the users in an instance of time. It estimates the energy consumption by the job and deadline. It distribute to the clouds according to the request of service.

3. Job sequencing: The cloud1, cloud2, cloud3 accept all the provided jobs and apply the existing job sequencing with deadline algorithm[11] to get the optimal job sequence with minimum energy constraint parameter that all the provided jobs are completed within scheduled deadline and consume the minimum energy. It also rejects the jobs that do not processed in the deadline.

4. The requested data has sent to the appropriate user.

V. SIMULATION RESULTS

This section illustrates the energy efficient task scheduling method for the e-Governance services using the federation of cloud. At any instance of time there are 46 jobs with the dead line and the estimated energy requirement in the sequence. The central cloud service broker distributes the jobs on cloud1, cloud2, cloud3. If a user requests for the passport, the central cloud service broker would create the job J13 because the cloud1 is intended for the service of passport and the service number is three.

Total Number of Jobs : 46

****** Main Job Queue ******

Job	J27	J23	J17	J38	J28	J31	J26	J15	J12	J37	J36	J32	J24	J26	J18
Energy	17	57	55	58	18	78	38	10	23	43	58	86	52	37	37
Deadline	6	12	6	7	13	4	7	11	3	12	6	13	11	4	12
Job No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

J15	J16	J21	J31	J21	J17	J30	J26	J29	J25	J27	J28	J12	J31	J15	J22
40	85	63	10	26	40	43	43	43	61	47	11	36	56	78	25
12	11	8	6	4	10	8	13	1	13	8	13	8	5	11	13
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

J29	J17	J14	J35	J17	J13	J35	J23	J36	J23	J19	J24	J21	J27	J23
88	16	62	82	51	28	41	79	14	70	13	79	18	80	73
8	5	1	6	2	6	9	2	8	12	11	7	13	4	9
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46

VI. ANALYSIS OF SIMULTION RESULT

We analyse the above simulation result by taking execution time of each job that should be less than deadline and calculate the total average waiting time, Average turnaround time and consumed energy for First Come First Serve, Shortest Job First, Round Robin and Job Sequencing with deadline algorithm [11]. The comparison chart of the scheduling methods is given below for the above data set of cloud1.

Table: 1. Comparison of Scheduling methods

****** Cloud 1 Before Optimisation ******

Job	J17	J15	J12	J18	J15	J16	J17	J12	J15	J17	J14	J17	J13	J19
Energy	55	10	23	37	40	85	40	36	78	16	62	51	28	13
Deadline	6	11	3	12	12	11	10	8	11	5	1	2	6	11
Job No	3	8	9	15	16	17	21	28	30	33	34	36	37	42

****** Cloud 1 After Optimisation ******

Job	J14	J17	J12	J17	J13	J17	J12	J17	J15	J19	J18	J15
Energy	62	51	23	16	28	55	36	40	10	13	37	40
Deadline	1	2	3	5	6	6	8	10	11	11	12	12
Job No	34	36	9	33	37	3	28	21	8	42	15	16

The optimal solution is J = {34, 36, 9, 33, 37, 3, 28, 21, 8, 42, 15, 16 } with a Energy of 411.

****** Cloud 2 Before Optimisation ******

Job	J27	J23	J28	J26	J24	J26	J21	J21	J26	J29	J25	J27	J28	J22	J29
Energy	17	57	18	38	52	37	63	26	43	43	61	47	11	25	88
Deadline	6	12	13	7	11	4	8	4	13	1	13	8	13	13	8
Job No	1	2	5	7	13	14	18	20	23	24	25	26	27	31	32

****** Cloud 2 After Optimisation ******

Job	J29	J21	J26	J27	J26	J27	J24	J23	J28	J28	J21	J22	J26
Energy	43	26	37	17	38	47	52	57	11	18	18	25	43
Deadline	1	4	4	6	7	8	11	12	13	13	13	13	13
Job No	24	20	14	1	7	26	13	2	27	5	44	31	23

The optimal solution is J = {24, 20, 14, 1, 7, 26, 13, 2, 27, 5, 44, 31, 23 } with a Energy of 432.

****** Cloud 3 Before Optimisation ******

Job	J38	J31	J37	J36	J32	J31	J30	J31	J35	J35	J36
Energy	58	78	43	58	86	10	43	56	82	41	14
Deadline	7	4	12	6	13	6	8	5	6	9	8
Job No	4	6	10	11	12	19	22	29	35	38	40

****** Cloud 3 After Optimisation ******

Job	J31	J31	J31	J36	J35	J38	J36	J30	J35	J37	J32
Energy	78	56	10	58	82	58	14	43	41	43	86
Deadline	4	5	6	6	6	7	8	8	9	12	13
Job No	6	29	19	11	35	4	40	22	38	10	12

The optimal solution is J = {6, 29, 19, 11, 35, 4, 40, 22, 38, 10, 12 } with a Energy of 569.

Scheduling Method	Average Waiting Time	Average Turnaround Time	Consumed energy
FCFS	39.7142	45.2857	41
SJF	24.42	30	41
RR	46.071	52.071	41
JS	18.75	24	34.25

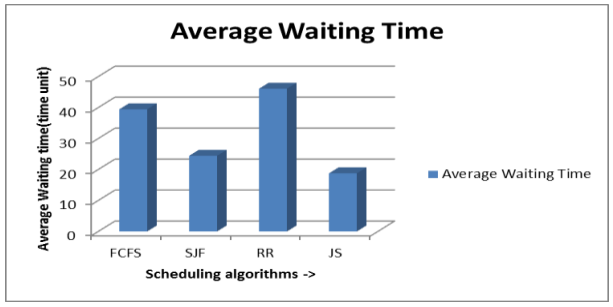

Figure: 4. Comparison of Average Waiting Time with Scheduling methods

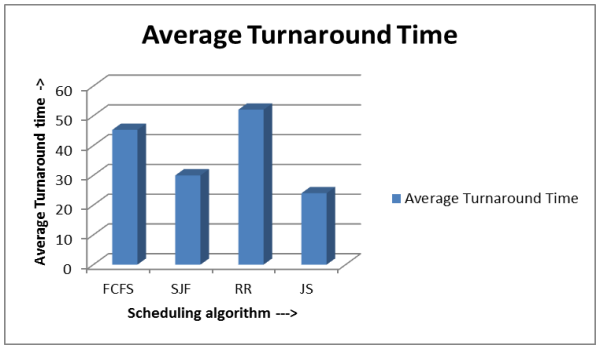

Figure: 5. Comparison of Average Turnaround Time with Scheduling methods

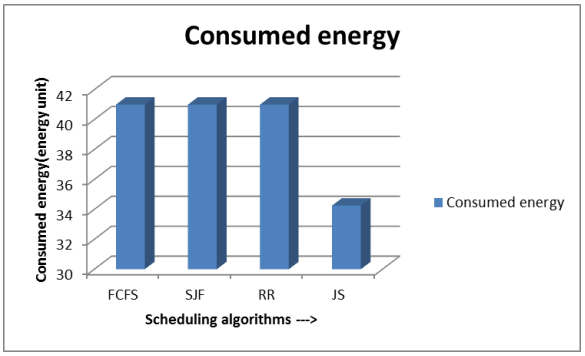

Figure: 6. Comparison of Consumed Energy with Scheduling methods

VII. CONCLUSION

The proposed framework for e-Governance will provide the quality of services to the users for e-Governance services and the same would also balance the load using the federation of clouds. The framework serves the user's requests within the deadline and consumes minimum energy. As can be observed from figures 4-6, the proposed job sequencing framework with existing Job sequencing with deadline algorithm [11] provides the optimal job scheduling with minimum energy consumption, minimum waiting and turnaround time, as

compared with other job scheduling techniques namely FCFS, SJF and RR.

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