CHAPTER 3

EFFICIENT RESOURCE ALLOCATION IN CLOUD ENVIRONMENT WITH DEVELOPMENT OF INTERFERENCE AWARE TECHNIQUE

3.1. INTRODUCTION

With huge scalable and virtualized property over the internet, cloud computing gains attention as a provider of dynamic services. Cloud computing uses large scale distributed environment and hence resource scheduling algorithms are on-demand. More specifically, in a cloud, a high communication cost reduction needs well suited resource schedulers to be exploited in a large scale distributed environment. According to recent studies, researchers challenge to design resource scheduling algorithms, that are appropriate and useful in cloud computing environment.

The work of resource schedulers in cloud computing is to decide, which resource satisfies the jobs request and according to it the resource allocation is done with respect to the workflow range. Scheduling hypothesis for cloud computing creates much awareness with an increasing popularity in the cloud era. Cloud computing is a representation to allow suitable, on-demand network access to a collective pool of configurable computing resources. In recent times, resource scheduling techniques of cloud computing are mainly focussed on setting up an optimization of the primary physical resources. But, there is no acceptable resource scheduling for suppliers from the part of the economic values in the cloud applications. Hence, more efforts are taken to fulfill the cloud provider with appropriate resource allocation algorithm.

The principle objective of this proposed work on resource scheduling in the cloud computing environment is to allocate the resources, based on the processing capability, electric power and network bandwidth. The resource scheduling process in cloud computing environment shuld be enhanced with a plan of Multitasking Based Resource scheduler in the cloud to allocate the resources with optimal energy and bandwidth consumption. The foremost thing is to allocate resources based on Interference Aware Resource Allocation (IARA) Technique. IARA Technique schedules the resources with process adoption of sub-optimization for the cloud computing problem. The IARA technique is designed with a special hardware support for localization by making it practical for resource-constrained Cloud environment. Mainly, IARA Scheduling Technique achieves both the allocation of the resources as well as utilization of the system resource. Simulation experiments conducted with various conditions to perform the resource scheduler in cloud computing and evaluation are carried out in terms of resource efficiency, evaluation time and energy utilization.

3.2. RESOURCE ALLOCATION IN CLOUD COMPUTING

The cloud is a category of parallel and distributed system with a group of interrelated and virtualized computers. In general, interrelated and virtualized computers are robustly provisioned and accessible as there are one or more unified computing resources based on service level agreements. Service level agreements are predicted through the cooperation between the service contributor and consumers. Moreover, the task of resource, allocation is reliably based on the request regarding the workflows and preferences of the users.

Generally, cloud computing intends to utilize the complete resources available. Resources are exposed as services on cloud computing proposal on receiving necessities and acknowledge the subscribers that it processes the Service Level Agreement (SLA). However, understanding the locality that the resources are common and the needs of the subscribers are possibly huge activate heterogeneity as well as platform insignificance. Cloud Computing will reveal to resource misuse if the resources cannot be dispersed correctly. In addition, cloud computing platform also wants to dynamically manage the load amongst the servers in order to avoid hotspot and also to offer resource effectiveness. As a result, the challenge lies in dynamically managing the resources to the fullest and professionally directing them. Besides, it should assemble the needs of the cloud subscribers and make sure that the problems are resolved.

The consumers access the applications and information of the cloud from everywhere at any time. However, complexity arises for the cloud service providers in allocating the cloud resources dynamically and efficiently. Moreover, physical resources, like computer processor, disk, database system, bandwidth, systematic instruments and reliable resources, like execution, monitoring, and communicating the function need equal attention.

3.2.1. Power of Virtualization Technique in Cloud Environment

Virtualization Technique supports an efficient resolution to the organization of active resources on cloud computing platform. The complexity in heterogeneity and the platform insignificance of the subscribers' needs should be handled at the time of the closing services. During the sealing of the service in the fundamental machines and assigning them to each of the physical servers resolve the issues in convincing the subscribers' requirements and at the same time the SLA is assured. In addition, Virtualization Technique is capable of performing remapping among the Virtual Machines (VM) and the physical resources, consistent with the load, vary in order to achieve the load equilibrium of the whole system in an active manner. Therefore, virtualization technology is being widely utilized in cloud computing.

Moreover, leading to the huge active heterogeneity of resources on cloud computing proposal, the virtual machines also stay proved into the cloud computing environment. Virtual machines reach its optimal utilization by completely exploiting their services and resources. However, the virtual machines (VM) need to satisfy the resource utility by balancing the owned resources correctly and thereby assuring load balancing. The challenge lies in the appropriate design of the VM resources so as to balance the load in cloud computing and to develop the resource effectiveness. Fig. 3.1 shows the essential organization of mobile cloud service provisioning.

Cloud Computes Service Provisioning

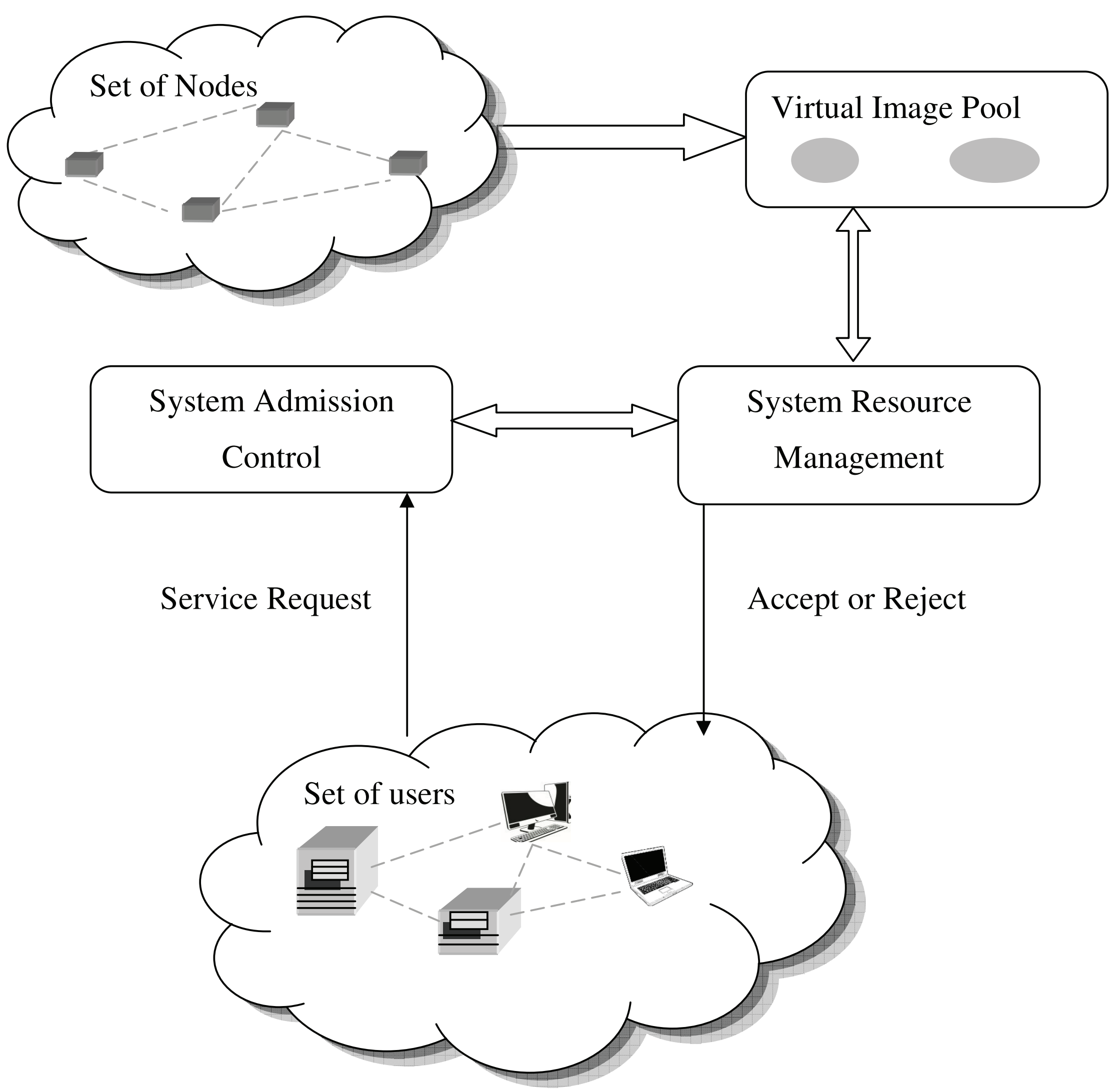

Fig. 3.1: Reference Model of Cloud Computing

Admittance control representation checks with the system resource organization model, when a mobile device requires a safety service to the cloud regarding the accessibility of the system resource like Virtual Images (VIs) as shown in Fig. 3.1. Each VI runs a section of the cloud system resources, like CPU, storage, etc. If there are obtainable VIs and the request is time-honored, then a VI or numerous VIs will be owed to that safety service by the system resource organization representation.

Takuro Tomita and Shin-ichi Kuribayashi, (2011) [58] have assigned the Resource process tasks to the machine. The particular tasks of a processing job, allocated to the various types of Virtual Machines (VM) are automatically instantiated and terminated during the job execution. Daniel Warneke and Odej Kao, (2011) [11] discuss the usage of Congestion control methods to decrease the size of the necessary resources for the congested resource type instead of restricting all the service requests. However, the existing works do not evaluate the impacts of the number of users, resource types, and centers of performance. Imad M. Abbadi., and Anbang Ruan., discuss (2013) [24] the scheduling of resources in the cloud in a trustworthy manner as described in providing guaranteeing of the users with virtual resources but takes a high computation time. Olivier Beaumont., et al., (2012) [8] discuss the number of changes in allocation, induced by a client arrival which is very small with additive resource augmentation on the side of the server, using NP-complete causing high polynomial time complexity. Considering the limits of the existing works, the proposed work aims to offer a proper resource allocation strategy by mainly avoiding the interferences happening in between the infrastructure and ad-hoc network link. Further, the proposed work aims to achieve both the speed of resource allocation and the utilization of system resource.

3.3. DEVELOPMENT OF INTERFERENCE AWARE RESOURCE ALLOCATION TECHNIQUE

Multi-user cloud environment receives a huge attention with proper resource allocation ideas. IARA Technique in multi-user cloud computing environment aims to achieve perfect resource allocation thoughts and to overcome the limitations faced in the existing works. IARA Technique is analyzed in an interfering environment with the optimal sub-channel to find the rate of the computing communication cost. The system setup in IARA Technique is made in such a way, that it provides an accurate interference-priority responsive resource allocation which leads to a convex optimization crisis. An IARA optimal solution is elaborated further in the successive sections. The architectural diagram of the resource allocation using IARA Technique in cloud environment is shown in fig 3.2.

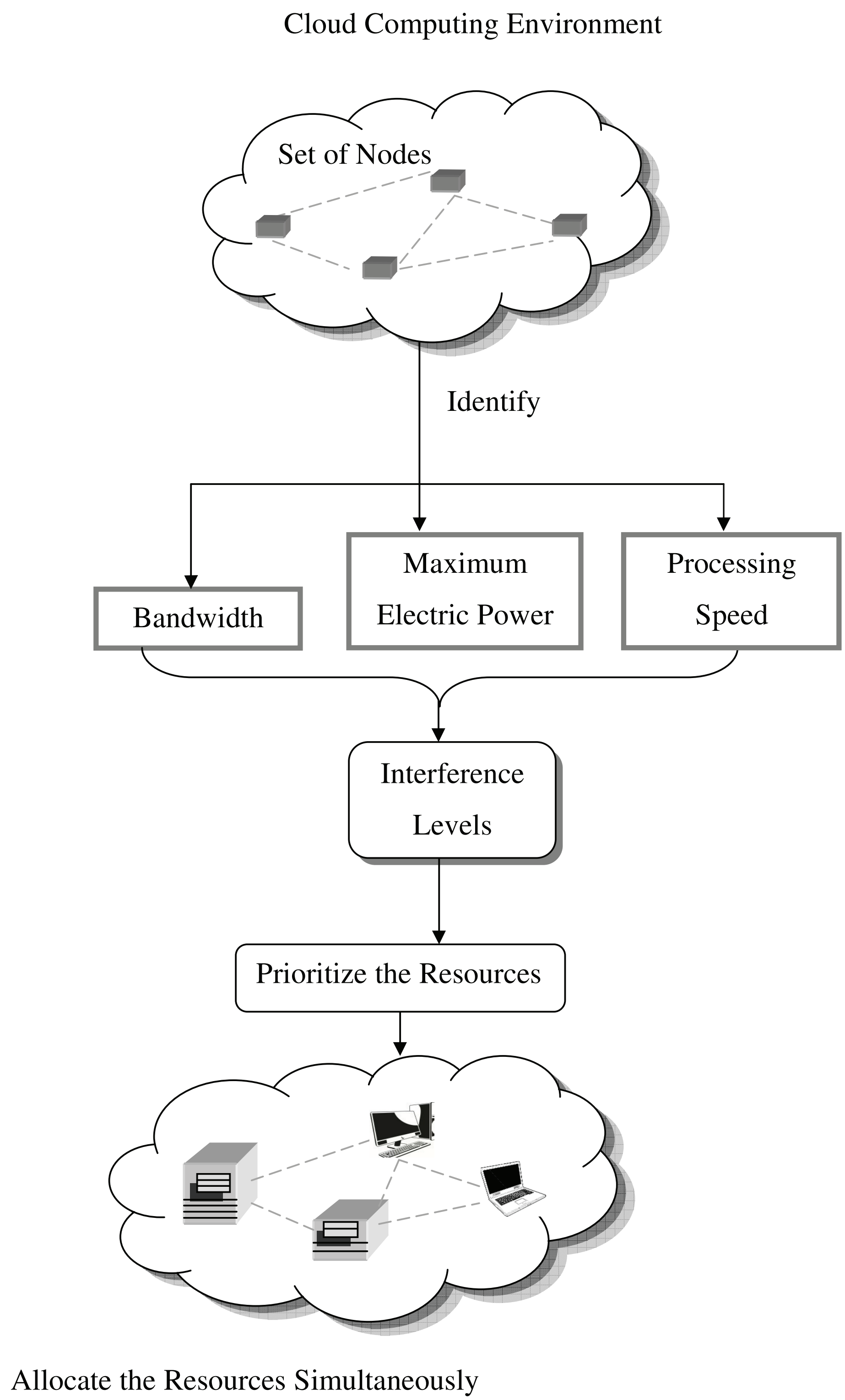

Fig. 3.2: Architecture of Resource Allocation Using IARA Technique in Cloud Environment

Fig 3.2 describes the process of allocating the resources in the cloud computing environment. Based on the activities, like resource selection, monitoring, tuning and allocation of resources, IARA Technique achieves better system resource utilization. Moreover, IARA Technique is accurate to resolve the convex optimization problem with optimal solutions. The infrastructure system evolves in frames of permanent duration't' and uses a physical layer with 'n' sub channels. For minimalism, focus is on a single infrastructure client and its connection to the base station. The results are, however, willingly extended to the container of multiple clients as long as these are served on orthogonal sets of sub-channels. Based on the detection of the movement of the ad-hoc network at the opening of every frame, control and broadcast time are allocated as per the sub channel in IARA Technique.

3.3.1. Infrastructural System Arrangement Facilitates

Allocation of resource pool in respect to every request for a certain period of time in IARA Technique is based on its processing capability, bandwidth and maximum electric power. For a potential cloud computing services, IARA Technique performs load balancing in order to obtain high reliability in the system management. Every area includes servers with high processing capability, maximum electric power and network devices associated with high bandwidths to process the cloud requests.

Maximum electric power is abound in servers and the maximum network resources take a high-capacity battery series at the area of the cloud computing environment. On request of the cloud service, one optimal area is chosen from the overall areas. At the same time, the processing capability and bandwidth in the chosen area are determined along with the electric power capability for the service requested at a certain period. If no area is found with sufficient processing ability, high bandwidth and electric power capability then the request will be discarded. On receiving the service requests, the resource allocation is made, based on the metrics, such as the processing ability, high bandwidth and electric power capability. After which, the interference level is decided to provide reliable service to the requests with better resource allocation. An elaborate system setup of IARA Technique is discussed in the next section.

3.3.2. System Setup of IARA Technique

The system setup of IARA Technique is constructed with a set of ad-hoc nodes. The ad-hoc nodes in IARA Technique leads to a convex optimization problem solving. The structural setup transmissions originates from for the considerable interference in ad-hoc transmissions by sensibly allocating the resources and reducing the transmission time of the design setup. The principle of resource allocation for the relevant nodes in the clouds is done based on their resource requirements as represented in the dispersed process accepted by the individual node agents in the system. Theoretically, every node is same in operating the tasks of resource allocation constantly with resource selection, monitoring, prioritizing, tuning and finally allocation of the resources.

The ad-hoc system works constantly in time, based on a decentralized and distributed medium access. The joint on/off behaviour is designed, based on a two-state continuous time with the transition rates 'μ' and 'α' in the ON and OFF state, respectively. The difficulty is simply exploited to the various ad-hoc system arrangements that work in the parallel frequency bands. The most positive way of time allocation is based on per-frame sensing results, obtained by deriving the construction of the optimal solutions.

The infrastructure system comprises frames of permanent duration't' and uses a physical layer with 'n' sub channels. For simplicity purpose, the concentration should be on a single infrastructure client and its link to the base station. But the results are readily opened to the container of the multiple clients, given that the container is served on the orthogonal sets of the sub-channels. Moreover, the control and broadcast time are allocated, based on the detection the movement of the ad-hoc network at the opening of every frame, as per the sub-channel in the proposed technique.

The representation of IARA Technique for a cloud computing environment is made in such a way that various resources from a common resource pool are used at the same time to every request for a definite period of time. The resource allocation representation that includes these statements is depicted in Fig.3.3.

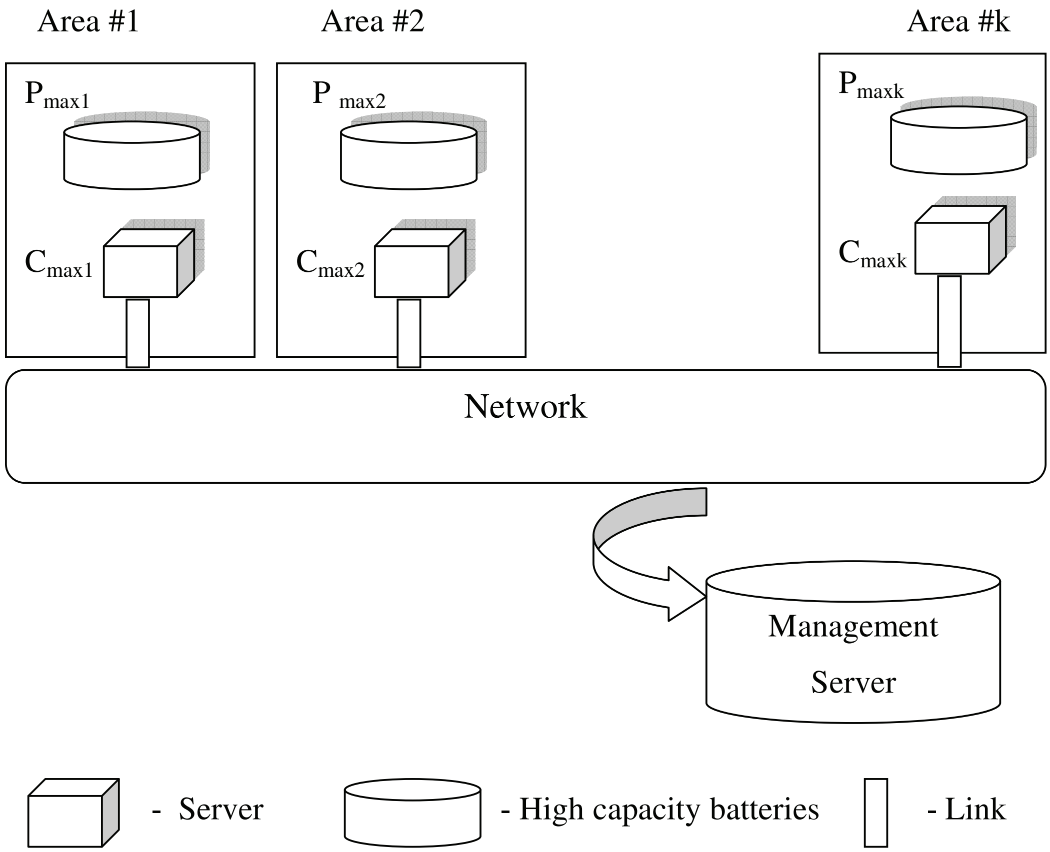

Fig 3.3 Architecture of the Resource Allocation Model

In general, IARA Technique allocates the resource types based on the processing ability, electric power and bandwidth. It should be considered that the physical facility to provide cloud computing services are widely seen in various areas. Therefore, it is necessary to build a proficient cloud computing service with facilities, like easy to augment the number of the services when the demand raises, proper load balancing reliability.

Every area contains servers or counting virtual servers. Each server includes its own processing capability and network devices that expose the bandwidths to process the servers. The electric power is abound to the servers and network devices by a high-capacity series positioned in each area. P_{max1} denotes the maximum power allocation; C_{max1} denotes the maximum capability to process and N_{max1} is the maximum network devices used in the cloud computing environment.

Let P_{maxj} be the most powerful electric power capability, obtainable from the series in Area #j. Moreover, it is also specified that, if one area faces a deficiency in electric power capability, then the devices in that area cannot access the electric power in the other areas. As IARA Technique concentrates on the optimal resource distribution in the case where P_{maxj} electric power capability in Area #j is obtainable from the ICT devices.

On receiving a service request for the need of the resource, appropriate steps are taken. The foremost thing is to select a optimal area from k areas, and forecast processing capability and bandwidth in that area. Based on the processing capability and bandwidth of the selected area, the resource is allocated appropriately to the request for a definite period with maximum electric power capacity. If no area has adequate resources, like processing ability, bandwidth and electric power capability for a new request, then the request is discarded.

Resource allocation is achieved to expose the constraint that the communication link sustains a precise rate condition *R*. Based on the power distribution 'p' and transmission time portion ***t***, the sum rate of the infrastructure link of IARA Technique is specified by

$$\sum_n t_n \log\left(1 + k\frac{p_n |h_n|^2}{t_n N_0}\right) = \sum_n t_n \log\left(1 + \frac{p_n \beta_n}{t_n}\right) \quad \dots (1)$$

Where N_0 specifies the noise power, κ is a normalization factor, and β_n is launched for notational convenience. P_n is the number of time power allocated, h_n is the resource allocated and t_n transmission time portion in 'n' times.

3.3.3. Interference Parameter

The main principle objective of IARA Method is to reduce the average interference between the infrastructure and ad-hoc links. Therefore, in order to fulfill the objective, the expected time overlap between the transmissions of the infrastructure and the ad-hoc connection, which will form the cost function is to be found. The cost function is minimized by the allocation procedure. Based on the IARA technique of the ad-hoc link, its transition matrix is given as

$$p(q) = \frac{1}{\alpha+\mu}\left[\mu + \alpha e^{-(\alpha+\mu)q}\right] \quad \dots (2)$$

$$p(q) = \frac{1}{\alpha+\mu}\left[\mu - \mu e^{-(\alpha+\mu)q}\right] \quad \dots (3)$$

The ad-hoc system is observed in state ‘y’ at time ‘t’ through spectrum sensing; [P](x, y) which is the probability of it being in state ‘x’ at time t+q. $p(q)$ is the amount of time, ‘q’ taken to allocate the resource based on the power and continuous time with transition rates μ, α in the ON and OFF state, respectively. After the formation of the transmission link, if the chain is ergodic, then it is well-known that these probabilities converge to the stationary distribution in a monotonic fashion.

The functions φ0 (t_n) and φ1 (t_n) are strictly convex and increasing in t_n. Both φ0 (t_n) and φ1 (t_n) are nonnegative linear combinations of a convex and follow a strictly convex function. One is linear and the other has an exponential function with a non-zero exponent. The monotonicity is easily verified by differentiation. Based on the functions φ0 (t_n) and φ1 (t_n), the problem of minimizing the interference power, which impacts the ad-hoc links can be formulated as

$$min_{p,t} = \sum_n \frac{p_n}{t_n} \emptyset_y(t_n) \qquad \ldots (4)$$

$$S(p,t) = \sum_n t_n \log(1 + \frac{p_n + \beta_n}{t_n}) \geq S \qquad \ldots (5)$$

Where the objective function S (p,t) represents the expected transmit power that overlaps with the transmissions of the ad-hoc system.

$$\sum_n p_n \leq P \qquad \ldots (6)$$

p_n >=0 … (7)

Where $0 <= t_n <= 1$

Note that $p_n$denotes the total transmit power that is allocated to a sub-channel. The peak power is, therefore given as p_n/t_n. In adding up to the rate constraint (5), there is a total power constraint (6). The above optimization problem is not convex as the intention al function is not convex in [p, t]. As a result, equation (4) to equation (9) considers a convex approximation, which lends itself to a more tractable solution.

3.3.4. Power Utilization in IARA Technique

Time overlap objective function in IARA Technique reduces the maximum power utilization ‘p’. However, an important factor in leveraging the channel diversity, based on the knowledge of the channel coefficients β_n is considered. The objective function‘t’ convex, the rate constraint convex in [p, t] and all other functions are linear in the decision variables. Although the convex program me in IARA Technique are solved using the general solution techniques, the special structure is further used to reach at a low-complexity solution.

In order to reduce the total power utilization of all the areas, several servers and network devices of every achievable areas are set to sleep mode on form that each area, but maintains enough processing ability and bandwidths to route a new request. The energy power capacity is more essential during the calculation to obtain a definite amount of processing ability and bandwidth.

The principle of allocating resource to the relevant nodes in the clouds to gather their resource requirements is termed as a dispersed process. The dispersed process makes sure that the accepted out resource suits the individual node agents in the system. Theoretically, every node in similar in running the tasks allocated to it and it constantly achieves a cycle of three activities by IARA Technique,

(i) *Placement*, where a appropriate node, able to run the specified task is established and the task is assigned to that node;

(ii) *Resource allocation*, where the node supervises its resource requirements as stated by the application agents;

(iii) *Tuning,* where the node endeavours to alter its resource assignments

3.3.5. IARA Algorithm

The algorithm below describes the process of resource allocation in cloud computing environment, based on interference awareness.

Input: Set of tasks t, set of resources r, set of nodes n

//Resource allocation

Select t from set of tasks in the state of unassigned
Identify the nodes which are all set free
Assign the node to the respective task

// monitoring and tuning

```
For all t
    Assign the respective n
    Identify the resources r needed to complete the task
    Assign the resources to the node which has utilization in a
    reasonable boundary
    If task t <= time
        Release the resource
    Else
        Maintain the resource until the task is complete
    End if
End for
```

In resource allocation, the node chooses an unassigned job from its task collection and tries to identify an appropriate node with accessible resources that can achieve the task. Resource utilization is the measure that makes sure that maximization of resource exploitation is taken into account, while the rate of change in resource usage depends on the firmness of the obtainable resource treatment on a node. Nodes constantly check their resource exploitation and their job necessities. At last, IARA is able to achieve a better resource allocation by avoiding the interference between the infrastructure and ad-hoc network in the cloud environment.

3.3.6. Resource allocation: Case Study

Consider a set of resources R and set of tasks be T. Identify the task "t" which has not been assigned a resource. Compute the amount of resources needed to complete the task t. There are three major activities under monitoring and tuning:

Case 1: If a resource is available for the respective task t, allot the resource to that node and process the task.

Case 2: If a partial set of resources are available i.e., for 3 resources, if, only 2 resources are available in the environment, then identify the size of the task to be performed. For all the assigned tasks, a node checks the changes in its resource necessities and alters the resource allocations if required; if such alteration is not probable, a task substitution might be triggered;

Case 3: If a node completes its task, it then manages the resources inside a local boundary. A node also checks its resource alteration to remain within the utilization inside a logical boundary;

Case 4: At last, any resource that is timed out needs to be released.

The above case scenarios are followed for the process of allocating resources in a constrained way by using the IARA technique.

3.4. EXPERIMENTAL EVALUATION

For experimental discussions, three set of parameters are taken to estimate the performance of IARA Technique and are compared with the existing works, like Congestion Control Method of Takuro Tomita and Shin-ichi Kuribayashi (2011) [58] and Dynamic Resource Allocation Method of

Daniel Warneke and Odej Kao, (2011) [11]. CloudSim Simulator compiles codes through the Command prompt or through CloudSim with Eclipse, Netbeans, etc. providing an easy process. The specified CloudSim Simulator has been selected as a simulation platform as it is a present simulation structure in Cloud computing environments. Cloud availability structures at transmission layer carry out the optimal analysis based on custom configurations, supported within the CloudSim. Compared to the simulation toolkits (e.g. SimGrid, CloudSim), JAVA CloudSim provides a copy of the on-demand virtualization with enabled bandwidth and submission management.

IARA work simulates a data center comprising 100 heterogeneous physical nodes. Each node is presented with a CPU core equivalent to 1000, 2000 or 3000 MIPS, 8 GB of RAM and 1 TB of storage. Power consumption by the hosts is defined according to the model described in Section 3.2. According to IARA model, a host consumes 175 W with 0% CPU utilization, up to 250Wwith 100% CPU utilization. IARA work uses Statlog (Shuttle) Data Set from UCI repository with 9 attributes, all of which are numerical and thereby improving the data validation accuracy to 80%. The instances in the actual dataset are in time order, and this time order can most probably be related to clustering.

The users present need for provisioning the 290 assorted VMs that pack the power of the virtual data center. Each VM runs a web-application or any kind of application with a variable workload, which is modeled to generate the utilization of CPU according to a uniformly distributed random variable. The application runs for 150,000 MI and that is equal to 10 min of the execution on 250 MIPS CPU with 100% utilization. Initially, the VMs are owed along with the demanded uniqueness assuming 100% CPU utilization. Each experiment has been run for 10 times. The performance of IARA Technique is evaluated in terms of resource efficiency, evaluation time and energy utilization rate.

3.5. RESULT ANALYSIS

Result analysis section compares the efficiency of IARA Algorithm with metrics, like resource efficiency, evaluation time and energy utilization rate in a quantitative evaluation. The table and graph, given below analyze the IARA Technique with the existing Congestion Control Method of Takuro Tomita and Shin-ichi Kuribayashi, (2011) [58] and Dynamic Resource Allocation Method of Daniel Warneke and Odej Kao, (2011) [11] for resource allocation in the cloud computing environment.

3.5.1. Measure of Resource Allocation Efficiency

Resource efficiency means using the limited resources in a sustainable manner, while minimizing their impacts on the cloud environment. Efficiency of resource allocation is decided, based on the handling capacity of the system with a large number of tasks assigned by the nodes in the cloud environment. The efficiency of the IARA is compared with the existing Congestion Control method and Dynamic Resource Allocation Method as shown in table 3.1.

Table 3.1
Tabulation of Resource Allocation Efficiency

No. of Resource Request	Resource Allocation Efficiency (%)		
	IARA Technique	Congestion Control Method	Dynamic Resource Allocation Method
20	68	32	25
40	73	35	30
60	76	41	33
80	80	44	37
100	84	48	42
120	87	53	45
140	92	57	48
160	95	59	52

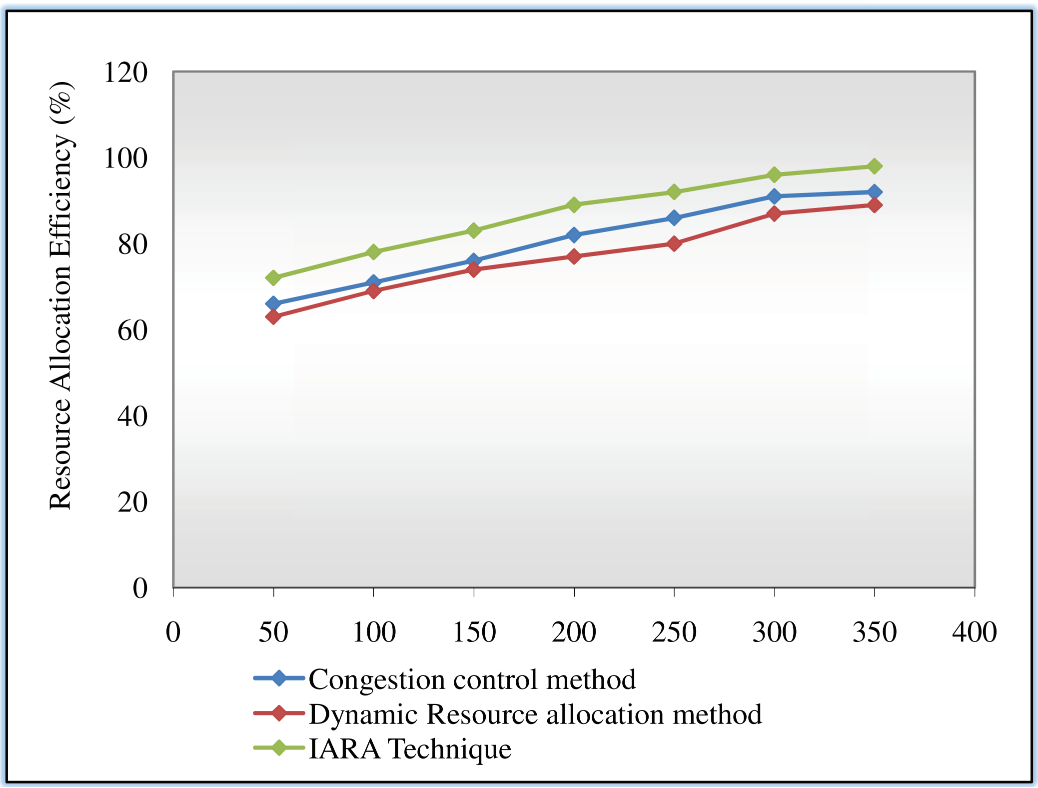

Fig 3.4 Measure of Resource Allocation Efficiency

Fig. 3.4 describes the efficiency measure in resource allocation based on the assignment of the tasks done by their respective resources. IARA achieves better resource efficiency of about 10-15% when compared with the Dynamic Resource Allocation Method Takuro Tomita and Shin-ichi Kuribayashi (2011) [58] and nearly 5-9% Compared with Congestion Control Method of Daniel Warneke and Odej Kao, (2011) [11]. The existing Dynamic Resource Allocation Method is inapplicable to allocate resources for large data centers, based on the coarse-grained model. Similarly, in the Congestion Control Method, allocation is done based on the processing ability and bandwidth. If the main task has less processing ability, resource utilization in the congestion control method will fail. On the other hand, IARA Technique reduces the energy utilization by setting the unused several servers and network resources in every area to sleep mode. Therefore, on achieving this, each area still maintains enough of the processing ability, bandwidths and electric power to route a new request. In addition, the interference between the infrastructure and ad-hoc network is avoided and thus provides better resource efficiency.

3.5.2. Measure of Evaluation Time in Allocating Resource

Evaluation time means time taken to assign a set of resources by considering the task weightage in a cloud computing environment. Evaluation time in resource allocation is measured based on the number of resources available in the cloud environment and the time required to allocate the resources to the nodes as per their requirements. Respective resources are allocated, based on the awareness of the nodes present in the cloud computing environment.

Table 3.2
Tabulation of Evaluation Time

No. of VM	Evaluation Time (seconds)		
	IARA Technique	Congestion Control Method	Dynamic Resource Allocation Method
2	0.1	0.1	0.13
4	0.19	0.23	0.26
6	0.29	0.34	0.38
8	0.28	0.31	0.39
10	0.49	0.53	0.64
12	0.68	0.67	0.86
14	1.04	1.02	1.25
16	1.1	1.16	1.3

The evaluation time of the proposed IARA is compared with the existing Congestion Control Method and Dynamic Resource Allocation Method as shown in table 3.2.

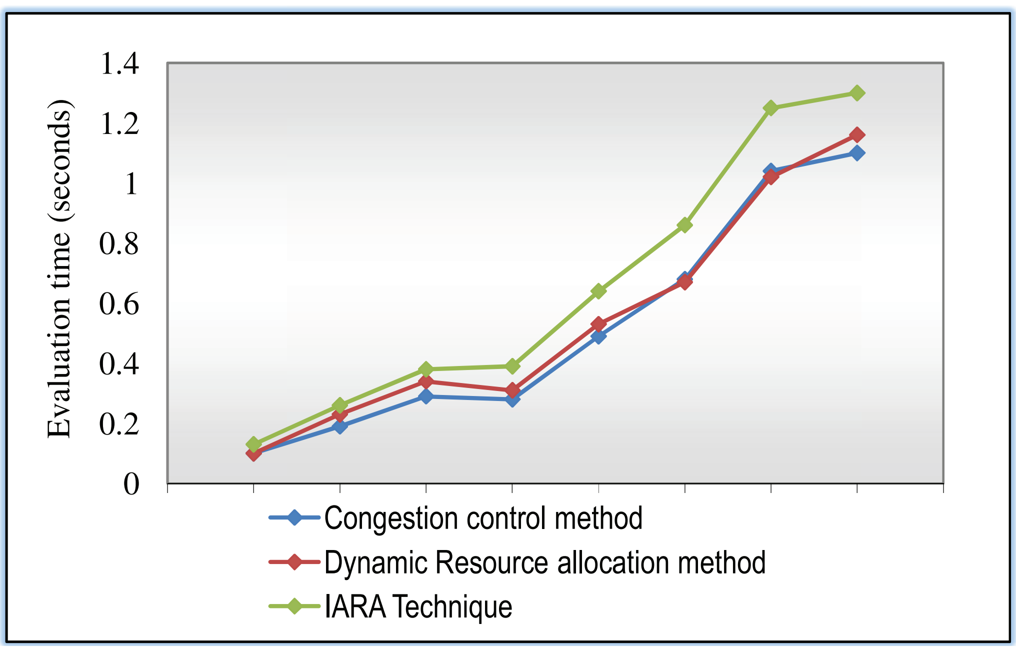

Fig 3.5 No. of Virtual Machine vs Evaluation Time

Fig 3.5 describes the evaluation time based on the availability of the resources obtained in the environment. IARA Technique consumes an evaluation time of about 18-36% compared to the Congestion Control Method of Takuro Tomita and Shin-ichi Kuribayashi, (2011) [58] and 11-30% than Dynamic Resource Allocation Method of Daniel Warneke and Odej Kao, (2011) [11]. IARA technique allocates resources based on sub-optimization, with dispersed process considering processing speed and bandwidth in specific period. Moreover, before allocating the resources, IARA Technique will first monitor the activities of the task for the nodes in the datacenter reducing the evaluation time. But Congestion Control Method takes extra time in searching the respective resources because of a fixed data centre. Even Dynamic Resource Allocation Method fails to pre-observe the task and thereby causing the maximum time requirement in resource allocation.

3.5.3. Measure of Energy Utilization Rate

Energy utilization rate defines the utilization or consumption of energy in allocating the resources to the nodes in a cloud computing environment. The utilization of energy is the periodic measure of the virtual machines, utilized by the nodes in the cloud computing environment. Most of the current works concentrate on the heterogeneous environment which requires more energy to allocate the resources. But, in IARA Technique, the allocation of resources is done efficiently in a planned manner, by localizing the hardware to their respective clouds.

Table 3.3
Tabulation of Energy Utilization Rate

No. of VM	Energy Utilization Rate (%)		
	Proposed IARA	Congestion Control Method	Dynamic Resource Allocation Method
5	17	25	30
10	21	29	35
15	26	34	39
20	30	39	45
25	33	45	52
30	37	49	57
35	41	53	63
40	45	60	70

Energy utilization rate of the IARA Technique is compared with the existing works Like Congestion Control Method and Dynamic Resource Allocation Method as illustrated in table 3.3.

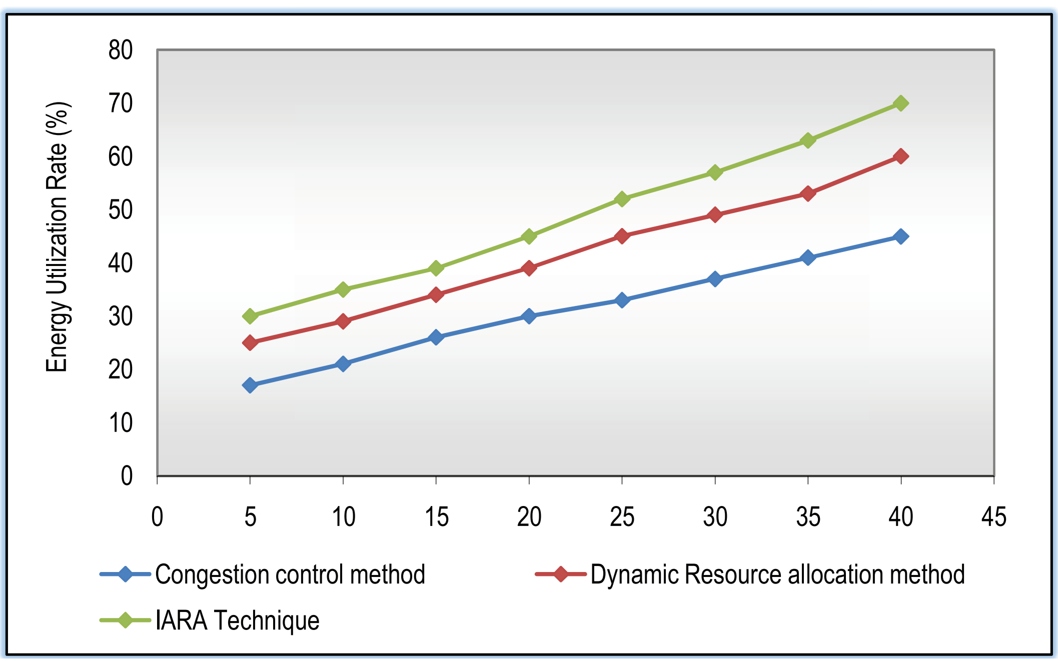

Fig 3.6 Measure of Energy Utilization Rate

Fig 3.6 describes the energy utilization rate in respect to the number of resources available. In contrast to Congestion Control Method of Takuro Tomita and Shin-ichi Kuribayashi, (2011) [58] and Dynamic Resource Allocation Method of Daniel Warneke and Odej Kao, (2011) [11] IARA Technique has approximately 32-45 % and 14-20 % lesser utilization of energy. As in IARA Technique, the allocation of resources is more focused resourcefully in an intended way, by localizing the hardware to their respective clouds.

Finally, it is being observed that the IARA Technique works efficiently with resource allocation process, using the interference aware resource allocation method. Resource allocation process follows the special hardware support, localized by the resource constrained cloud environment to enhance IARA Technique.

3.6. SUMMARY

A novel approach for resource management in computing clouds named, IARA Technique is introduced to sense and predict the behaviour of the ad-hoc system for allocating the resources. IARA Technique is on demand for resource allocation strategy due to the need in achieving the user fulfillment and in also reducing the profit for the cloud service providers in cloud pattern. IARA Technique involves a shared design of resource allocation model with special hardware support for localization of the resource constrained environment.

Moreover, IARA Technique improves the resource scheduling process in the cloud computing environment. IARA aims to perform a Multitasking Based Resource Scheduler to allocate the resources with the optimal energy and bandwidth consumption in cloud environment. IARA Technique minimizes the evaluation time in resource scheduling on adoption of sub-optimization for the cloud computing problem. IARA Scheduling Technique achieves both the perfect resource allocation and proper utilization of system resource with the aid of the processing capability and the network bandwidth on the basis of process efficacy. Simulation is conducted with a set of experiments, in terms of resource efficiency, evaluation time and energy utilization rate. The simulation results prove that the IARA Approach is efficient in resource allocation process and it can achieve the optimal result in contrast to the existing congestion control and dynamic resource allocation methods. For instance, IARA Technique achieves approximately 14 -45 % lesser utilization of energy, when, compared with the existing methods, using the localization of their hardware in the respective clouds.