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Resource Discovery and Dynamic Resource Allocation Using MHACA and HOA Algorithm in Cloud Environment

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Abstract: *Resource allocation is used to assign the available resource in a best way. It is the scheduling of activities and the resource required by those activities while taking into consideration both the resource availability and the time. In this paper, we have proposed a method for optimal resource discovery and dynamic resource allocation. The proposed method consist of two phase namely resource discovery and resource allocation. For resource discovery the proposed method uses the Modified Hierarchal Agglomerative Clustering Algorithm (MHAC). Based on the MHAC algorithm the proposed tree construction is generated. After that the resource are allocated by hybrid optimization algorithm. In our proposed method, we use the hybrid Particle Swarm Optimization and Cuckoo Search algorithm (HPSOCS). Here Particle Swarm Optimization is used to optimize the tree construction path and cuckoo search is used Updation of particle swarm optimization algorithm. The resultant of the hybrid optimization algorithm is optimal path selection. Based on the optimal path the proposed method allocates the resource for the available resource.*

Keyword: *Resource allocation; Hierarchal Agglomerative Clustering Algorithm; Particle Swarm Optimization; Cuckoo Search algorithm;*

1. INTRODUCTION

Cloud computing is an attractive computing model since it allows for the provision of resources on-demand. Such a process of allocation and reallocation of resources is the key to accommodating unpredictable demands and improving the return on investment from the infrastructure supporting the Cloud [1]. There is growing interest in improving the energy efficiency of large-scale enterprise data centers and cloud computing environments [2].Resource discovery is an important process for finding suitable nodes that satisfy application requirements in large loosely coupled distributed systems [3].

Resource discovery enables applications deployed in heterogeneous large-scale distributed systems to find resources that meet QoS requirements. In particular, most applications need resource requirements to be satisfied simultaneously for multiple resources [4]. Optimal resource allocation and power management in virtualized data centers with time-varying workloads and heterogeneous applications [4].Clustering aggregation is a kind of formula description about clustering ensample [5]. The goal is to achieve the same quality of resource discovery as a global resource discovery system with full historical node-behavioral knowledge, but to significantly compress the amount of necessary node-behavioral representation data in the system in order to achieve scalability [6]. To provide efficient clustering without requiring the global knowledge of network by reversing the clustering approach from top-down to bottom up. With the bottom-up approach, sensing nodes build clusters before they select CHs [7]. The main challenge for any sentence clustering approach is language variability, where the same meaning can be phrased in various ways. For efficient clustering to take place, the inter cluster similarity should be maximum and the intra cluster similarity should be minimum [8]. In general, the clustering techniques are broadly divided into partition and hierarchical methods. K-mean is the most popular partition clustering algorithm which is based on centroids [9]. Agglomerative hierarchical clustering is one of popular clustering techniques [10].

The attribute based vector space model generalizes standard representations of similarity concept in terms of tree architecture [11]. The carrier aggregation (CA) technology allows scalable expansion of effective bandwidth provided to a user terminal through simultaneous utilization of radio resources across multiple carriers [12].It takes an input of pair wise data-item similarities and output a hierarchy of the data-items [13]. Carrier aggregation (CA) has been defined as an enabling technology to overcome the spectrum scarcity and fragmentation problem. CA allows a system to aggregate multiple spectrum resources and assign them to a single user in order to provide the sufficient

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bandwidth for a given service [14][15].Bundling, Adaptive algorithm and genetic algorithm based clustering aggregation methods.

2. RELATED WORK

Andrew Skabar, and Khaled Abdalgader [16] have proposed an novelty fuzzy clustering algorithm that operates on relational input data; i.e., data in the form of an square matrix of pair wise similarities between data objects. The algorithm uses a graph representation of the data, and operates in an Expectation-Maximization framework in which the graph centrality of an object in the graph was interpreted as likelihood. Results of applying the algorithm to sentence clustering tasks demonstrate that the algorithm was capable of identifying overlapping clusters of semantically related sentences, and that it was therefore of potential use in an variety of text mining tasks.

Yong Zhang et al [17] have proposed disadvantages of excessive clustering time because of the possible uneven cluster density. As a result, they present an ASMC algorithm. That proposed algorithm provides adaptability to mobile nodes and has no limitation to the network extensibility. Experiments by the improved J-Sim simulator shown that proposed algorithm evens up the cluster density and extends the network lifetime, compared with the results of LEACH and HEED.

Mohammad GhasemiGol et al [18] have proposed a hierarchical method; they extended the hierarchical clustering algorithm to cluster fuzzy data for the first time. Finally that approach has been compared with some of the newly presented methods in the literature. The major advantage of the algorithm was its fault tolerance against noisy samples.

3. PROBLEM DEFINITION

In this section briefly discussed the problem definition shown below

- While using resource usage histogram provides a means to capture representation of individual nodes.
- The dynamic resource usage pattern and enables the satisfaction of statistical resource requirements potentially creates a scalability problem.
- The major problem is time complexity.
- Agglomerative hierarchical clustering is not good at handling huge data sets because of the computational complexity.

4. PROPOSED METHOD

To find out the resources and assign them in a cost effective way is the major intension of the suggested method. The suggested methodology contains 2 phases such as 1) Resource discovery and 2) Resource allocation. In the initial phase, the representative resource usage distribution for a group of nodes with related resource usage patterns is worked out as resource bundle which can be employed to simply find a group of nodes pleasing a common obligation. Now we offer the clustering-based resource aggregation such as Modified Hierarchal Agglomerative Clustering Algorithm (MHAC) to attain compact representation of a set of similarly behaving nodes for scalability. The general process is made cleared in the block diagram of the suggested method that is shown in Figure 1. The proposed method has two phases: (1) Resource discovery and (2) Resource allocation

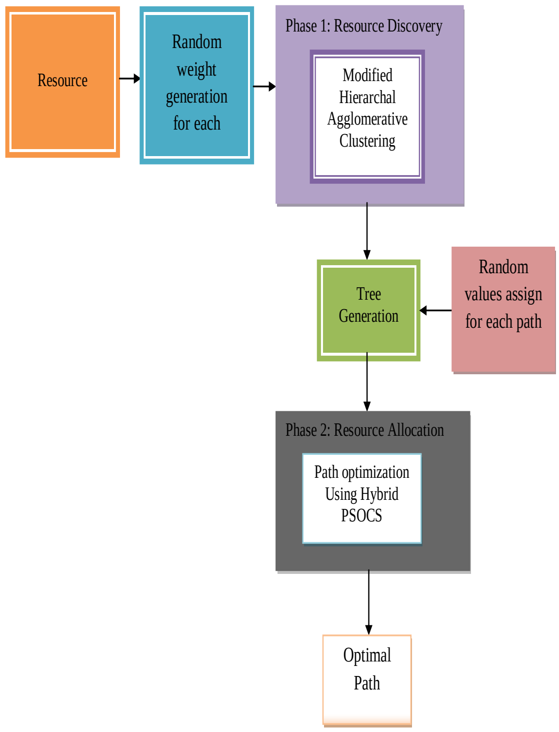

Fig.1 Block diagram of the proposed method

4.1. Resource Discovery Phase

Initially, weights are produced arbitrarily for the each node in the resource. The suggested method produces the tree construction based on the weights. Now adapted hierarchical agglomerative clustering algorithm is employed for the tree construction.

4.1.1. Modified Hierarchical Agglomerative Clustering Algorithm

Hierarchical clustering sequentially divides a dataset with a specified distance measure. There are two approaches to a tree of clusters; i.e. i) Agglomerative Hierarchical clustering algorithm or AGNES (bottom up) and ii) Divisive Hierarchical clustering algorithm or DIANA (top down). To improve the performance of traditional agglomerative algorithm, we employ adapted Agglomerative Hierarchical clustering algorithm. Now grouping of each node is based on the minimum distance with the random weight. The specified process of adapted hierarchical agglomerative clustering algorithm with example is set below,

Step 1: Allocate each node to a detach cluster with

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their weights

Step 2: Begin with the disjoint clustering having level L (0) = 0 and sequence number n = 0.

Step 3: Assess all pair-wise distances among clusters

Step 4: Erect a distance matrix by means of the distance values

Step 5: Look for the pair of clusters with the shortest distance

Step6: Increase the sequence number: n = n +1.Merge clusters (p) and (q) into a single cluster to form the next clustering n. Set the level of this clustering to L (n) = d [(p), (q)].

Step 7: Revise the distance matrix, D, by deleting the rows and columns corresponding to clusters (p) and (q) and adding a row and column corresponding to the recently formed cluster. The distance between the new cluster, denoted (p, q) and old cluster(r) is described in this way: d [(r), (p, q)] = min (d [(r), (p)], d [(r), (q)]).

Step 8: Replicate till the distance matrix is decreased to a single element.

4.1.2 Example

Regard as a resource with five nodes. Now each node is symbolized as N1, N2, N3, N4 and N5. Initially we produce the random weight for each five node. We generate tree based on the weight by means of agglomerative hierarchical clustering algorithm.

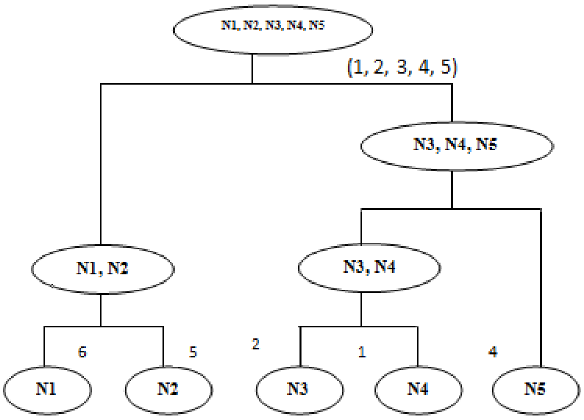

Fig. 2 Example of modified agglomerative hierarchical clustering algorithm

Now we choose the random weights are (1, 2, 3, 4 and 5). Grouping among nodes are based on the distance with the weight. Now node N3 and N4 are the minimum weight so that are grouping each other (N3, N4). Similar as node N1 and N2 are the minimum weight that is merging to (N1, N2). Next the novel group (N3, N4) and node N5 containing the minimum weight so, forming novel group or cluster (N3, N4, N5) similarly. At last all nodes are clustered together and form a single cluster (N1, N2, N3, N4, and N5). We go for the phase two after the tree construction.

4.2. Resource Allocation Phase

Based on the hybrid optimization algorithm the resource will be assigned in this phase. To assign the resource for the task, we produce the random value for each path in the tree construction for the intention of finding the best path. Each path in the tree construction is produced a random values in the range of [0, 1]. Let as reflect on a tree construction with number of path, it is revealed in Fig.3. The tree contains n number of leaf nodes and their related weights based on these each nodes are clustered together. The path connected to each leaf node and their tree construction is specified beneath,

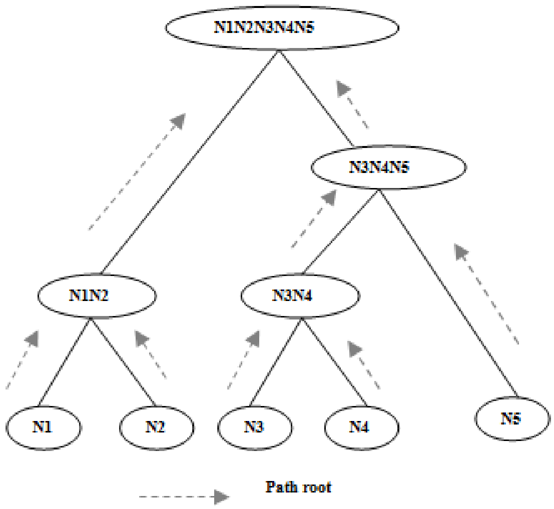

Fig 3: The tree construction with path root

In our suggested method we allocate the random values for each path after finding the path for the complete leaf node. Our tree construction contains five paths, each path allocating the random values in the range of zero to one. After that the paths are optimized by means of the hybrid particle swarm optimization with cuckoo search algorithm. The specified process of hybrid optimization elucidated in lower section,

Path1: (N1)-(N1N2)-(N1N2N3N4N5)→0.5

Path2: (N2)-(N1N2)-(N1N2N3N4N5)→0.7

Path3: (N3)-(N3N4)-(N3N4N5)-(N1N2N3N4N5)→0.9

Path4: (N4)-(N3N4)-(N3N4N5)-(N1N2N3N4N5)→0.2

Path5: (N5)-(N3N4N5)-(N1N2N3N4N5)→0.4

4.2.1. Optimization Using Hybrid Particle Swarm Optimization with Cuckoo Search

The suggested method employ hybrid particle swarm optimization with cuckoo search for the optimization problem. Now particle swarm optimization (PSO) is employed to optimize the path and Cuckoo search is employed to revise the initial solution from the particle swarm optimization. Each individual particle i has an arbitrarily initialized position $X_i = (X_i^1, X_i^2, \cdots, X_i^d)$ where X_i^d being its position in the dth dimension, velocity, $V_i = (v_i^1, v_i^2, \cdots, v_i^d)$ where v_i^d being the velocity in the dth dimension, $bX_{Xi} = (bX_i^1, bX_i^2, \cdots, bX_i^d)$ where bX_i^d being the best position in the dth dimension and $gX = (gX^1, gX^2, \cdots, gX^d)$ where gX^d being the global best position in the dth dimension in the D-dimensional search space. Any particle can travel in the direction of its personal best position to its best global position in the course of each generation. The overall process is exposed in flowchart Fig.4. The moving process of a swarm particle in the search space explained as:

$$V_i^d = V_i^d + c_1.r_1.(bX_i^d - X_i^d) + c_2.r_2.(gX^d - X_i^d) \quad (1)$$

$$X_i^d = X_i^d + \delta V_i^d \quad (2)$$

Where,

c_1, c_2 - constants with the value of 2.0

r_1, r_2 - independent random numbers produced in the range [0.1]

V_i^d - Velocity of ith particle

X_i^d - Current position of the particle i

bX_i^d - Best fitness value of the particle at the current iteration

gX^d - Best fitness value in the swarm.

- Generate the particle: For a population size s, produce the particles arbitrarily.
- Find the fitness function: The fitness function select which should be employed for the constraints according to the present population. Now Eqn. (14) is employed for fitness function calculation.

$$fitness = \min \sum_{i=1}^{s} random\ values\ for\ each\ path \quad (3)$$

Initialize gX and bX: At first the fitness value computed for each the best one is chosen as the gX and bX value

- Velocity Computation: The novel velocity is worked out by means of the below equation. Replace with the c1 and c2 values in the velocity equation (1).
- Swarm Updation: Work out the fitness function again and revise the gX and bX values. If the novel value is better than the earlier one, substitute the old by the current one. And as well choose the best gX and bX. In our suggested method cuckoo search algorithm is employed for the swarm Updation.

Update the initial solution by levy flights. The excellence of the new solution is evaluated and a nest is selected among arbitrarily. If the excellence of new solution in the selected nest is better than the old solutions, it will be replaced by the new solution (Cuckoo). Otherwise, the previous solution is set aside as the best solution. The levy flights employed for cuckoo search algorithm is

$$X_i^* = X_i^{(d+1)} = X_i^{(d)} + \alpha \oplus Levy(n) \quad (4)$$

- Criterion to stop: Carry on till the solution is good enough or maximum iteration is attained

Finally we got the optimal path from the hybrid algorithm. The optimal path contains the number of optimal nodes. If one new task is arriving for allocating the resource, the proposed method utilizes the optimal path in which the best nodes are select for the new task. Based on this the proposed method allocate the resource for the available resource with time.

5. CONCLUSION

Optimal resource discovery and dynamic resource allocation was proposed in this paper. At first the resource were discovered based on the modified hierarchical agglomerative clustering algorithm (MHAC). Based on this the tree construction were generated. Next we allocate the resource using the hybrid optimization algorithm; here the particle swarm optimization and cuckoo search were hybrid in our proposed method. In our proposed method particle swarm optimization (PSO) was used to optimize the path and cuckoo search (CS) was used to update the population of the particle swarm optimization (PSO). From the outcome, we have showed that the available resources were allocated with efficient manner with minimum computation time. In future, the researcher can perform their platform with their own optimization technique and execute better.

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