Virtual Machine Placement In Cloud Computing Environment Based On Hybrid Approach

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Abstract-Now days cloud computing becomes one of the most remarkable computing paradigms for offering on demand provision and services through internet on many different levels. Now days main issue in cloud computing is to optimal selection of VMs with mulita objective targets. Our objective is to propose multi objective algorithms which can fulfil the purpose of energy efficiency, Quality of service and SLA agrements.We proposed hybrid approach by computing affinity of VMs and ranking then. Then computing the Resource usage factor to placing VM on a Suitable PM.
Keywords-Multi objective, Virtual machine, Resource utilization factor, Ranking, SLA.

1.Introduction

Cloud computing is an emerging internet-based practice to provides computing as a utility service. This technology is a popular model for providing Information Technology (IT) resources as a network-based service in a cost-efficient and pay-per-use method. Since cloud computing is new trends in IT outsourcing, organizations adopt and migrate to this technology for their business processes. Virtual machines in distributed systems have different usage conditions including; utilization costs and also different processing power. The users' jobs may also have the different amount of information. In addition, to allocate appropriate resources on any machine to the jobs, the response time1 is also considered. The most important problem in this process is the ordering process and how placement the tasks on resources are conducted. In fact, by increasing the productivity of resources, the response time can be reduced and simultaneously, can improve the total cost of resource utilization and load equalization.

Multiobjective improvement considers optimization issues involving over one objective perform to be optimized at a similar time. Multiobjective improvement problems arise in several fields, like engineering, economics, and supply, once optimum selections got to be taken within the presence of trade-offs between 2 or a lot of conflicting objectives. for example, developing a replacement component may involve minimizing weight whereas maximizing strength or selecting a portfolio may involve maximizing the expected come whereas minimizing the chance.

Authors[7]here this work, author tend to propose an ant Colony optimization (ACO) primarily based joint VM migration model for a heterogeneous, Mobile Cloud Computing primarily based enhanced health care system for smart city environment. During this model, the users quality and provisioned VM resources within the cloud address the VM migration disadvantage.. Author additionally present a thorough performance analysis to analyze the effectiveness of the projected model compared to progressive approaches.

Authors[4]here methodology of proposed optimized algorithms for virtual machines placement based on multi objective characterstics.Paper is composed of two main task scheduling and load balancing. Authors[20worked on hybrid algorithm. Paper is composed of two algorithm.SA is used for local search optimization while IWD is used for global search optimization. Resulting approach is fast to implement.

Authors[1]research issue the author targeted on how to minimize the power and energy consumption in allocation of VMP.This paper proposed improved PSO algorithm by redefining the parameters and operators.Authors[15]here in this paper the author described concept of affinity based VMP in cloud environment. Author proposed a model which evaluates the similitudes between virtual machine and host.VM will be placed on those host who have highest affinity advantages. Authors[10]this work considered network traffic as a input for placement problem.VMs are clustered based upon traffic networked. Thus proposed algorithm shows quick and efficient results to improve the placement.

Proposed Work-

A Process for VM Placement

- ✓ For each host/server/physical machine, calculate resource demand of application the use of servers' resource utilization statistics over an amount of time (e.g., many days/weeks/months).

- ✓ Choose a target server with compatible virtualization software, similar CPU types, comparable network connectivity, and usage of shared storage.
- ✓ Place the foremost VM on the first PM
- ✓ Place the 2nd VM to be place on equal PM if it will fulfill the resource needs. If not, add a new PM and vicinity the VM on this new machine.
- ✓ Continue until every of the VMs have been placed on a PM, including a replacement PM once needed.

2. Terminology and Problem Formulation

Notations used in the following problem formulation and the proposed algorithm are described and mentioned in Table I. Next, we detail resource wastage and power consumption models adopted by the proposed. We adopt the subsequent equation from [12] that is employed to calculate the resource wastage of the PMs. The resource wastage of i^{th} PM is as follows-

$$RW_i = NR_i^p - NR_i^m + \varepsilon / (NU_i^p + NU_i^m) \quad \textbf{(1)}$$

Here, ε is a small positive real number. The main idea behind the above equation is to make use of the resources efficiently in all dimensions and balance the remaining resources on each PM. We also adopt the following formula from [12] to calculate the power consumption of a PM. The power consumption of ith PM is given as

$$PC_{i=} \{P_i^{busy} - P_i^{idle} * NU_i^p + P_i^{idle}, NU_i^p > 0$$

$$\{0, \quad \textbf{(2)}$$

From Eq. (2), it's clear that the ability consumption of a PM is linearly proportional to CPU utilization [14]. In different words, PMs should be transitioned when they are in an idle state. Using Eq. (1) and Eq. (2), the total power consumption is calculated as shown below.

$$\sum_{i=1}^{m} PC_i = \sum_{i=1}^{m} y_i \times (X_i + Y_i) \quad (3)$$

where,

$$X_i = (P_i^{busy} - P_i^{idle}) \times \sum_{j=1}^{n} (x_{ji}.C_j)$$

$$Y_i = P_i^{idle}$$

The Total resource wastage is calculated as

$$\sum_{i=1}^{m} RW_i = \sum_{i=1}^{m} \left[y_i \times \frac{|A_i| + \varepsilon}{B_i} \right] \quad (4)$$

where,

$$A_i = (T_i^p - \sum_{j=1}^{n} (x_{ji}.C_j)) - (T_i^m - \sum_{j=1}^{n} (x_{ji}.M_j))$$

$$B_i = (\sum_{j=1}^{n} (x_{ji}.C_j) + \sum_{j=1}^{n} (x_{ji}.M_j))$$

Note that, if the values of variables y_i and x_{ji} are one, it means that ith PM is active and j_{th} VM is assigned to it. Then the objective of the VMs placement is to

Minimize $= \sum_{k=0}^{n} \quad PC_i$ *and* $\sum_{k=0}^{n} \quad RW_i$

Subject to:

$$\textit{Minimize} \quad \sum_{i=1}^{m} PC_i \;\; \textit{and} \;\; \sum_{i=1}^{m} RW_i$$

Subject to:

$$\sum_{i=1}^{m} x_{ji} = 1, \quad \forall i \in J \quad \text{(I)}$$

$$\sum_{j=1}^{n} x_{ji}.C_j \le T_i^p.y_i = 1, \quad \forall i \in I \quad \text{(II)}$$

$$\sum_{j=1}^{n} x_{ji}.M_j \le T_i^m.y_i = 1, \quad \forall i \in I \quad \text{(III)}$$

$$x_{ji}, y_i \in \{0,1\}, \; i \in I \text{ and } j \in J$$

$$TU^p = \frac{1}{m} \sum_{i=1}^{m} \left[\frac{\sum_{j=1}^{n} x_{ji}.C_j}{T_i^p} \right] \quad (5)$$

Constraint (I) defines that j^{th} VM is allowed place on i^{th} PM only. Constraint (II) and Constraint (III) defines that the sum of the CPU and memory capacities of the VMs placed on i^{th} PM repecively,should not exceed its threshold values

(T_i^m and T_i^p) repectively.Furthermore,we also use the following formula to calculate the total CPU utilization and total memory utilization of active PMs.They are as follows-

$$TU^m = \frac{1}{m}\sum_{i=1}^{m}\left[\frac{\sum_{j=1}^{n} x_{ji}.M_j}{T_i^m}\right] \quad (6)$$

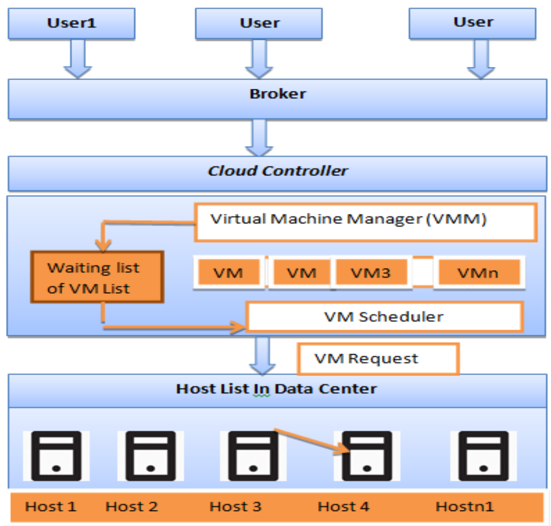

Figure 1. Framework for proposed Algorithm

Energy efficient VMP algorithms are becoming most hot and significant topics in cloud computing research paradigm. In this paper, evolutionary computing is applied in virtual machine placement to reduce the number of active host, therefore on schedule underutilized host to save lots of energy.

2.1 Proposed Methodology

In this section we have proposed and define model [13] as relationship between VMs in cloud computing environment and for each kind of resource like CPU and memory. Paper [13] also proposed an affinity model to computer the relationship between different VMs and their utilization.

Here we use follow [13] prediction method to predict the resource requirement of VMs based on their demand. By the help of prediction model we can compute the requirement.

Assume that n and m are number of VMs and PMs respectively. A VM_j is virtual machine represented by 2 tuples i.e. $VM_j(C_j, M_j)$.Initially at time t assumes the resource requirement of VM_j is d for T time slots on basis of prediction model.

Predicted value is $V_i^c = (R_i^c(t+1), R_i^c(t+2), R_i^c(t+3) \ldots\ldots\ldots R_i^c(t+T))$ and again resource requirement of another VM_k is same as VM_j presented as $V_k^c = (R_k^c(t+1), R_k^c(t+2), R_k^c(t+3) \ldots\ldots\ldots R_k^c(t+T))$.Now if VM's resource requirement tends to be smooth and steady then they will place together.

$$u_{ik}^d = \sum_{d+1}^{T}(R_i^d(t+\delta t) + R_k^d(t+\delta t))\ /T \quad \textbf{(9)}$$

$$A_{ik}^d = \sum_{d=1}^{D} \quad A_{ik}^d \quad \textbf{(10)}$$

Let R_j be the rank of VM_j and it is computed as

$$R_j = |A_{ik} - C_j| \quad \textbf{(11)}$$

Arrange VMs in decreasing order of their ranks and waiting in a queue called $VMList$ for placement.

3.VM Placement Algorithm

Placing virtual machine on suitable and most appropriate host is important and this placement is called as virtual machine placement. From the set on n physical host pick out a host randomly H_j and assume that there K_j VMs that are already placed on it.For Placing other VM on host we should forest co putting reaming resources in host for this it should satisfy some conditions i.e. Remaining resource of host m must be greater than the requirement of virtual machine that is –

$X_j^d(t) = \sum_{k=1}^{k(j)} \quad R_k^d(t) \geq R_i^d(t)$ (12)

Let VM v to be placed on one of the PM having D dimensional resources demands of VM v is given as $(R_v^1, R_v^2, R_v^3, \dots \dots R_v^D)$.Now calculate resource usage factor of each PM .This factor is usable for selecting a suitable PM for placement of a VM request and also improve the resource utilization of the PM.

The RUF of a PM p for VM v is calculated as follow-

RUF (p, v)= $\sum_{d=1}^{D} \quad A_p^d * B_p^d * C_p^d$ (13)

So VM is placed on PM with highest RUF value and the PM has sufficient resource to accommodate the VM.We can compute RUF by following [6] formulae-

Average resource Utilization

$A_p^d = \frac{1}{n} * \sum_{v=1}^{n}(a_{vp}R_v^d)/T_p^d$ **(A)**

Normalized resource utilization

$B_p^d = \sum_{v=1}^{n}(a_{vp}R_v^d)/T_p^d$ **(B)**

Normalized remaining resource

$C_p^d = \sum_{v=1}^{n}(T_p^d - a_{vp}R_v^d)/T_p^d$ **(C)**

VMPHA Algorithm

1. Initialize $TU^p = TU^m = 0$;
2. For each i Ɛ I
3. for each PM p Ɛ P
4. Initialize $RW_i = P_i$=I_{active}=0;
5. Initialize T_i^p=T_i^m=100%

TESTING RESOURCES

6. 6.R=True;
7. 7. For d=1 to D do
8. 8.For k=1 to K(j) do
9. 9. $C_j^d(t) = C_j^d(t) - V_k^d(t)$ // Remaining resources
10. 10.End for
11. 11. If $C_j^d(t) < V_i^d(t)$ then
12. 12. R=False;
13. 13.End if
14. 14. End for

VM PLACEMENT PHASE

15. Update the vectors $U_p^d = R_v^d / T_p^d$ //Usage State//
16. End for
17. For k=1 to n do
18. For each VM v of V
19. For each PM p of P
20. if (C_v)
21. Max=RUF(p,v)
22. Placement(VM_k)==0;
23. i==0;
24. if (place (VM_k)==0) then
25. i++;
26. While $(i \leq m)$;
27. If then
28. $VMSet_i$=$VMSet_i$U {VM_k};
29. Place (VM_{set})==1;
30. Break;
31. for each VM v of V
32. for each PM p of P

If ($C_v \leq T_p^{cpu}$ && $M_v \leq T^{mem}$ && max < RUF(p,v))then
max=RUF(p,v)
q=p
    Else
  i ++;
  if(i>I_{active}) then I_{active}=I;
End if
End while
End if
End for
 For i=1 to I_{active} do
Compute PC_i *and* RW_i
End for
Compute TU^{cpu} and TU^{mem}
End

In table I we can use following parameters to implement our work.

3.1 Table I. Parameters and their values [12]

Parameter Name	Value
$T^p{}_i$	100%
$T^m{}_i$	100%
Pbusyi	215 W
Pidlei	162 W
$\|J\|$	20-100
E	0.0001

4.CONCLUSION-

So the given methodology of combine method based on Affinity model and Resource utilization factor. We have following conclusions-

- ✓ In our proposed methodology, we have used Affinity model to groups the VMs based on their resource requirement. The AM helps in find VMs with extreme resource requirements. As a result, assign those VMs with extreme (outlier) resource first helps in minimizing resources and number of active VMs.Then calculate RUF and place VM in suitable PM.
- ✓ There will be no migration mechanism need to adopt in the proposed, hence, no migration cost.

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