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Middleware Layer Reliability Assessment in Multi Cloud Computing System

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***Abstract*—** Enterprises are majorly adopting cloud computing which offers a large pool of services to users. But the capability of cloud computing is limited and some enterprises often require various cloud centers to integrate in order to deliver services to business users. So Multi Cloud Computing System (MCCS) provides integrated services across multiple autonomous clouds. Based on the dynamic parameterization of Virtual Machines (VM) an MCCS platform can build effectively. Thus multiple VMs can collaborate to provide as service with a transparent manner, facilitates a scalable environment, allocate resources dynamically and supports unlimited computing and storage service capabilities. Thus VM plays an important role in MCCS. This paper focuses on middleware layer and proposes framework for reliability assessment mechanism of middleware layer of MCCS.

Keywords*-Multi Cloud Computing System, Virtual Machine;, Reliability, Virtualaization.*

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I. INTRODUCTION

Virtual Machines [1] are fundamental components of computer architecture committed to providing the functionality of a physical computer hence it is an imitation of the computer system. Virtualization [2] leads to the creation of independent environments that use the operating system to execute user programs to deploy on the server or client hardware. Reduces the capital cost, memory space through virtualization and is also used for efficient resource management [3], high availability [4], ease of migration [5], auto scaling [6], and fault tolerant [7] benefits. Virtualization is deployed through hypervisor that supports multiple operating systems simultaneously on virtual servers within a physical server [8]. Recent trends in cloud computing increase virtualization further. Multi cloud computing systems (MCCS) supports a vibrant technical environment where innovative solutions and services can be deployed. MCCS deploys software on multiple Clouds [9] there by overcomes single cloud provider unavailability and allows to develop cost efficient applications and services.

MCCS supports high availability by distributing partitioned user tasks on a number of VMs if one VM fails the other VM will carry the work load of failed VM. The existing work in this area only considers the timeliness for checking the correctness of result and without a choice for algorithms for different types of applications. Hence a performance evaluation [10] model for MCCS is needed that efficiently carried out by Layered Software Reliability Assessment Paradigm which compartmentalizes the MCCS as three layers like physical server layer, Middleware layer or Virtualization layer or VM layer, and Application Layer. The user can interact the MCSS through application layer and the necessary resources needed to execute the user request are allocated by physical server layer with the help of dynamic allocation on VMs in middleware Layer. This paper focuses on issues related to middleware layer and methodology involved in the assessment of the reliability of middle ware layer. The VM layer contains hypervisor [11] responsible for hosting, monitoring and managing all VMs of this layer.

II. RELATED WORK

Reliability assessment of MCCS is a complex task which encompasses a variety of services available to a variety of users. Sheheryar Malik [12] et al describes the significance of MCCS reliability assessment and proposes a model for reliability assessment of VM by proposing efficient scheduling mechanism that provides fault tolerant infrastructure. N. Chandrakala [13] et al proposes a method to find the reliable VM to process the data owner request with indexing mechanism and the reliability assessment method is used to discover the reliable server to respond the request gracefully to unexpected hardware or software failure. Z. Dai [14] et.al. describes transparent check pointing at the user's level provided by Distributed Multi cloud Check Pointing using dependability factors check points with various parameters. Damiani [15] et. al. focuses on a reliable resource selection mechanism based on reputation.

III. FRAMEWORK OF VIRTUALIZATION LAYER

Due to elasticity [16] and scalability of MCCS cloud service reliability is a major research issue. Virtualization technique ensures the availability of hardware for every application running on top of it. The details of the virtual, simulated environment are kept transparent from the application. The service requests from different users from different regions are submitted to pool of cloudlets through various cloud service providers are integrated before submitting them to pool as in Fig 1.

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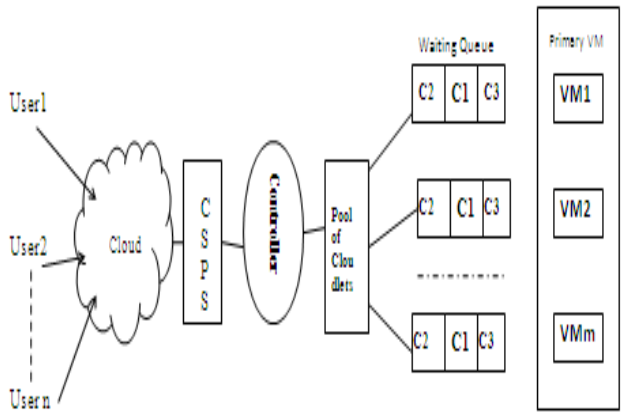

Fig 1: Framework of Middleware Layer

The cloudlet [17] is portioned into small tasks and is scheduled on different VMs dynamically using algorithm1 with a number of cloud service providers as NC, for each cloud VMs are allocated user specified probability distribution based allocation scheme. This model generally considered that one physical server can host multiple VM, but one VM can handle only one service instance [18].

Algorithm 1: VM Allocation

```
Select SET (NC)
for 1 to NC do
Select SET (VM instance)
for each VM instance i do
Select 0 <= PROB i <= 1
end for
Set ∑ PROB =1
Select VM count >=0
for 1 to VM count do
        Sum =0
        Generate random number 0<= r <=1
        for prob i in PROB do
                Sum = sum + prob i
                if r <= sum then
                        Allocate VM of type i
                end if
    end for
end for
end for
```

IV. Assessment of Reliability

Let R_{VM} is the reliability of a VM Layer and rel_{vm} is the inner reliability of a VM, μ_{vm} the internal failure rate of VM then internal reliability of a VM is assessed with exponential reliability model by

$$rel_{vm} = e^{-\mu_{vm} t}$$

Then reliability of VM layer is assessed by considering non service VMs and reliability of server layer into account as follows

$$R_{VM} = rel_{vm} * R_{server}$$

Reliability of application layer is same as user service reliability through which user can directly interact with MCCS. Let rel_{app} is the internal reliability of a service, R_{app} is the reliability of an application and μ_{app} is internal failure of an application then

$$rel_{app} = e^{-\mu_{app} t}$$

Reliability of application layer is

$$R_{app} = rel_{app} * R_{vm}$$

V. Evaluation and Results

MCCS is created by using Amazon EC2 [19] cloud with 3 virtual machines each having the following configuration.

S NO	Virtual Machine Description	Value
1	Memory	2048 MB
2	Mips	500
3	Bandwidth	1000
4	No. of Processors	2

Table1: Virtual Machine Description

Cloudlet of different sizes are submitted to MCCS, the processing time and memory utilization of VMs are observed. The processing time of VMs over ten clock cycles for different cloudlet execution is described by Fig 2.

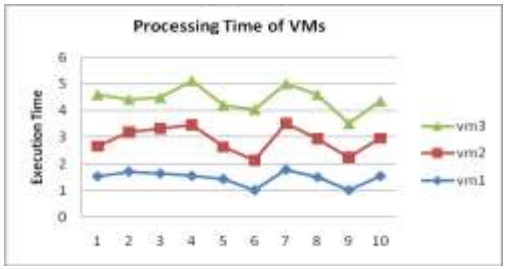

Fig 2: Processing Time of VMs

Another parameter which is very important for cloudlet execution in MCCS is memory space utilization of VMs over ten cycles are illustrated in Fig 3.

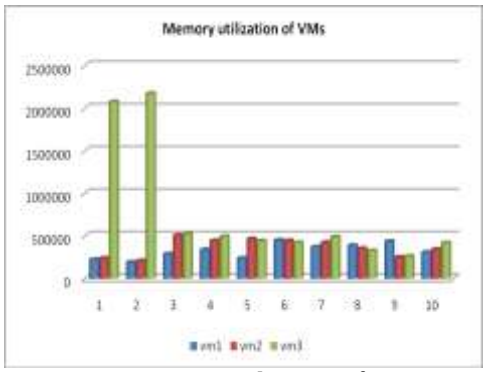

Fig 3: Memory utilization of VMs

The reliability of virtualization layer that consists of three VMs are compared by taking into account processing speed, memory, bandwidth utilization and execution time of cloudlet is described by Fig 4.

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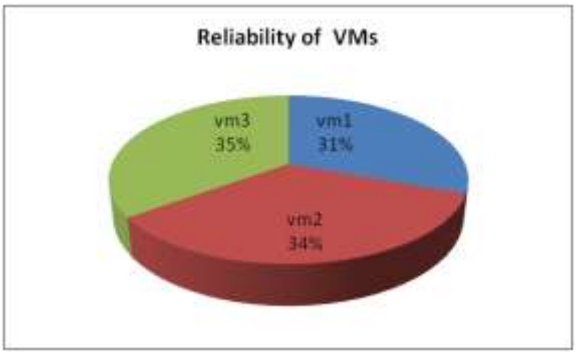

Fig 4: Reliability of VMs

VI. CONCLUSION

Reliability is an important factor in MCCS, in this paper we briefly described the environment of MCCS, how modularity is achieved through layers of MCCS reliability assessment paradigm and method of evaluation of reliability of middleware layer of reliability assessment paradigm. We also contributed algorithm for dynamic allocation of VMs in middleware layer and can be beneficial in terms of time and space utilization over static allocation of VMs. In future research can be emphasizing on deploying multiple service instances on single VM and algorithms can be developed for assessment of multi instance reliability.

REFERENCES

[1] B. Sotomayor, R. S. Montero, I. M. Llorente, and I. Foster, "Virtual Infrastructure Management in Private and Hybrid Clouds," IEEE Internet Computing, vol. 13, no. 5, pp. 14–22, Sep. 2009. [Online]. Available: http://dx.doi.org/10.1109/MIC.2009.119.

[2] J. H. Son and M. H. Kim, "An analysis of the optimal number of servers in distributed client/server environments," Decision Support Systems, vol. 36, no. 3, pp. 297–312, Jan. 2004.[Online].Available:http://linkinghub.elsevier.com/retrieve/pii/S0167923602001422.

[3] Vahid Khoshdel and Seyed Ahmad Motamedi, Saeed Sharifian, "A New Approach for Optimum Resource Availibility in Cloud Computing Environments"- International Conference on Computer and Knowledge Engineering Oct. 13-14, 2011.

[4] T. Setzer, M. Bichler, and B. Speitkamp, "Capacity Management for Virtualized Servers," in INFORMS Workshop on Information Technologies and Systems (WITS), Milwaukee, USA, 2006.

[5] M. Nelson, B.-H. Lim, and G. Hutchins, "Fast transparent migration for virtual machines," in Proceedings of the annual conference on USENIX Annual Technical Conference, ser. ATEC '05. Berkeley, CA, USA: USENIX Association, 2005, pp. 25–25. [Online]. Available: http://dl.acm.org/citation.cfm?id=1247360.1247385.

[6] X. Kong, J. Huang, C. Lin, P. D. Ungsunan, "Performance, Fault-tolerance and Scalability Analysis of Virtual Infrastructure Management System", 2009 IEEE International Symposium on Parallel and Distributed Processing with Applications, Chengdu, China, August 9-12, 2009.

[7] Jing Deng Scott C.-H. Huang, Yunghsiang S. Han and Julia H. Deng, "Fault-Tolerant and Reliable Computation in Cloud Computing"- IEEE Globecom Workshop on Web and Pervasive Security 2010.

[8] W. T. Tsai, Q. Shao, X. Sun, J. Elston, "Real Time Service-Oriented Cloud Computing", School of Computing, Informatics and Decision System Engineering Arizona State University USA, http://www.public.asu.edu/~qshao1/doc/RTSOA.pdf.

[9] S. U. R. Malik, S. U. Khan, and S. K. Srinivasan, "Modeling and analysis of state-of-the-art vm-based cloud management platforms," IEEE Transactions on Cloud Computing, vol. 1, no. 1, p. 1, 2013.

[10] B. Yang, F. Tan, Y. S. Dai, and S. Guo, "Performance evaluation of cloud service considering fault recovery," Proc. Of the First International Conference on Cloud Computing, Beijing China, December 2009, pp.571-576.

[11] D. Ardagna, B. Panicucci, M. Trubian, and L. Zhang, "Energy-Aware Autonomic Resource Allocation in Multitier Virtualized Environments," Services Computing, IEEE Transactions on, vol. 5, no. 1, pp. 2 –19, jan.-march 2012.

[12] Sheheryar Malik, Fabrice Huet, Denis Caromel , Reliability aware Scheduling in Cloud Computing *https://www.ijarcsse.com/docs/papers/Volume_5/6_June2015/V5I6-0558.pdf*.

[13] N. Chandrakala and P. Sivaprakasam Reliable VM identification in Multi Cloud Environment International Journal of Computer Applications (0975 – 8887) Volume 65– No.15, March 2013.

[14] Z. Dai, F. Viale, X. Chi, D. Caromel, Z. Lu, ―A Task-Based Fault-Tolerance Mechanism to Hierarchical Master/Worker with Divisible Tasks‖, 2009 11th IEEE International Conference on High Performance Computing and Communication, Seoul Korea, June 25-27 2009.

[15] E. Damiani, D. C. di Vimercati, S. Paraboschi, P. Samarati, and F. Violante, A reputations-based approach for choosing reliable resources in peer-to-peer networks, in Proceedings of the 9th ACM conference on Computer and communications security, ser. CCS '02, Nov. 2002, pp. 207–216.

[16] W. Hu A. Hicks, L. Zhang, E. M. Dow, V. Soni, H. Jiang, R. Bull, and J. N. Matthews, "A quantitative study of virtual machine live migration," in Proceedings of the 2013 ACM Cloud and Autonomic Computing Conference. ACM, 2013, p. 11.

[17] A.M. Sampaio, J.G. Barbosa "Dynamic Power- and Failure-Aware Cloud Resources Allocation for Sets of Independent Tasks," Cloud Engineering (IC2E), 2013 IEEE International Conference on , vol., no., pp.1,10, 25-27 March 2013.

[18] W.T. Tsai, Q. Shao, X. Sun, and J. Elston, "Real-time service-oriented cloud computing," in Proceedings of the 6th IEEE World Congress on Services (SERVICES 2010), Jul. 2010, pp. 473–478.

[19] https://aws.amazon.com/ec2/