A review on Adaptive Fault Tolerance in Real Time Cloud Computing using Resource Awareness Module

Harsha Amipara[1] Prof. Upen Nathwani[2]
[1]M.E. Student [2]Assistant Professor
[1,2]Department of Computer Engineering
[1,2]Noble Group of Institution - Junagadh

Abstract— Cloud computing provide different services on internet using different service models. With the increases benefits and demands of cloud computing infrastructure, real time cloud applications can be performed on cloud infrastructure. A real time application can take advantage of demanding computing capabilities and scalable virtualized environment of cloud computing to execute real time tasks. In most of the real time cloud applications, processing is done on remote node in cloud computing. So there are more chances to occur errors or faults. The major problem area in cloud computing is fault tolerance. In this paper, we propose a model to analyze how system tolerates the faults and make decision on the basics of reliability of the Virtual machines that are processing nodes. In this proposed system, reliability is assessing using resource availability of all each virtual machine which provides correct output within time limit. So the reliability is calculated on basis of correctness, timeliness and resource availability for fault tolerance.

Key words: cloud computing, fault tolerance, virtual machine, reliability

I. INTRODUCTION

'Cloud' means the internet. 'Computing' means use of computer technology. Then, 'Cloud computing' means internet based computing With the use of cloud computing any user can have an access over the internet to data base resources as long as one needs without worrying about the maintenance and Storage of data. Cloud computing provides resources like physical services, storage, and networking using data centers. The cloud offers many services through cloud service providers. Today, the most popular cloud service providers are Google, Amazon, windows Azure etc...Each service provider provides different services based on the demand of the users. For example Amazon provide IaaS service (Infrastructure as a service), Google Provides all services like SaaS (Software as a service), PaaS (Platform as a service) and IaaS. To provide services to end users a cloud computing should be reliable and manage to provide output in minimum amount of time. So, fault tolerance and task scheduling are the two important parameters for virtual machine to be reliable.

II. BACKGROUND

Cloud computing has been widely used by industry, but still there are many research issues like fault tolerance, workflow scheduling, workflow management, security, etc. Fault tolerance is one of the major issue among all. Cloud computing support real time system is really important. Real time applications range from pacemaker to nuclear power plants and most of them are safety critical systems, which should be reliable. In general, real time system has respond to externally generated output within time limit. Therefore, the correctness does not depend only on result but also on time to deliver it. Real time cloud computing has three characteristics which are correctness, timeliness and fault tolerance. Correctness means the output result should be correct for each task. Timeliness means ech task in real time application should be finish its execution within time limit. And fault tolerance means task should continue to operate under fault presence.

Real time application uses cloud infrastructure, so it increases chances of errors or faults. The basic mechanism to achieve the fault tolerance is replication or redundancy [10]. We had performed the replication in form of variant software running on multiple virtual machines. Due to replication, cost renting the cloud resources will increase. But it is really required to avoid that disastrous loss.

III. RELATED WORK

The real time application are used cloud infrastructure is quite new concept. For this computing model is built on modern data centers made up of thousands of interconnected servers with capability of hosting a large number of applications [1]. So, these data centers are virtualized and computing resources are provisioned to the user as on demand services over internet using configurable virtual machine (VM) [5]. Lots of work has been already done in real time system for providing fault tolerance. However, there is need for fault tolerance in cloud computing. The users of real time computing cannot have full control over the nodes or the VM as they don't know exactly where their applications are execute. Because VM are far away from user. But on other good side, cloud provides a dynamic nature to the virtual machines, so any time VM can be removed if node is faulty and new node is added as per requirement [8].

X. Kong et. Al. [3,4] gave a model for the performance and fault tolerance of virtual infrastructure. However, it is not applicable to real time cloud system.

S. Malik and M. J. Rehman presented "Time Stamped adaptive fault tolerance of distributed real time systems"[7].

These models introduce the idea of time stamping with outputs of all nodes.

For non-cloud applications, a baseline model with distributed recovery block for distributed real time system is presented by K. H. Kim [6].

"A Formal approach for the fault tolerance of distributed real time system (RTS)", which is presented by J. Coenen and J. Hooman[10].

Sheheryar Malik anf Fabrice Huet present " adaptive fault tolerance in real time cloud computing" , they present model is based on adaptive reliability assessment of VM in cloud environment and fault tolerance of real time applications execute on VM, it has been done on basis of the reliability of VM.using timeliness and based on IP address

reliability is assessed. If two VM has same reliability then on basis of IP address decision is made[8].

Our proposed model is based upon adaptive reliability assessment of VM in cloud depending on correctness, timeliness and resource availability(memory, CPU.etc) techniques. The fault tolerance has been done on basis of reliability of VM using resource availability.

IV. PROPOSED MODEL

In this paper introduce a model which is an enhancement of the model which is proposed by Sheheryar Malik and Fabrice Huet in paper entitled "Adaptive Fault Tolerance in Real Time Cloud Computing". A scheme is proposed here which is for the real time applications execute on cloud. The model name is Adaptive Fault Tolerance in Real Time Cloud Computing using Resource Awareness Module**.** This scheme tolerates the faults on basis of reliability of each virtual machine. A virtual machine is selected for computation on basis of its reliability and can be removed, if it is not performing well for real time systems. The model is as shown in fig. 1.

In this model, we have two types of node. One is a set of virtual machines running on cloud and the other one is adjudication node. Virtual machine contains real time application algorithm and an acceptance test (AT) for checking correctness of output. On the adjudication node, we have the time checker (TC), Resource Awareness Module (RAM), reliability Assessor (RA) and Decision Mechanism (DM) modules.

In practice, we have N virtual machines on cloud which run real time application algorithm. The invariant real time application algorithm is run on virtual machines so in last we gat adaptive reliability on all virtual machines. The various algorithms running on different virtual machines have approximately equal computation time.
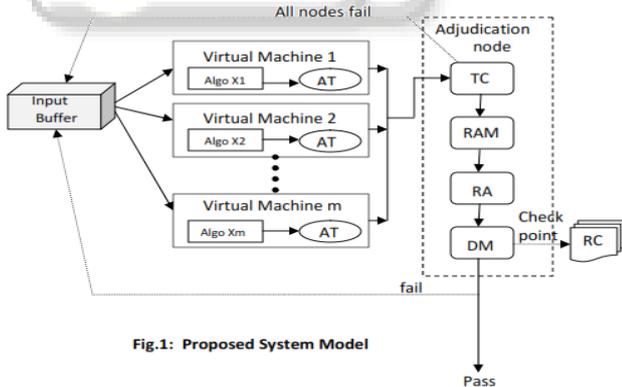

Fig.1: Proposed System Model

In this model, algorithm X1 runs on VM-1, X2 runs on VM-2, up to till Xm runs on VM-m. then we have AT module which is responsible for verification of output of each node for correctness. Then output are passes to TC module which check the timing of each node output. Then resource availability is check for all nodes RAM module. And then on basis of timing and resource availability RA module calculates and reassigns the reliability of each node. Then all the results are passed to DM module which selects the output on basis of highest reliability in each cycle. The node with highest reliability in all cycle is selected for further incoming task.

A. Working

As stated earlier, this technique has M virtual machine. Each node is taking input from the input buffer. This input is concurrently passed to all VM, which runs different software. Each node takes the input, executes algorithm and produces result. After checking correctness these results are passes to adjudication node. There are different modules in in the proposed model which are given different responsibilities. They are as follows:

1) Acceptance Test (At)

AT module is provide to each node (VM). It performs the acceptance test for each cycle output for all nodes. It verifies the correctness of the result produced by an eal time algorithm running on the same virtual machine. If the result is correct then passes to TC module otherwise indicate failure of result.

2) Time Checker (TC)

TC module is calculates time in milliseconds. It will checks the timing of results produced by each module. TC module passes the results to RAM (resource awareness module) module. It only passes the correct results of those nodes which produces the result before time limit. If all the nodes are fail to produce output within time limit then TC module perform the backward recovery.

3) Resource Awareness Module (RAM)

RAM calculates the resource availability of all node which are passed from TC module. Resource availability like memory, CPU usage etc. and passes result of TC module with resource availability to RA module it informs RA module to compute the new reliability of all VMs.

4) Reliability Assessor (RA)

This module assesses the reliability for each virtual machine. It is the main module of our proposed system. The reliability of all virtual machine is adaptive because it changes after every computing cycle. In the beginning, all VM have 100% reliability. If a virtual machine manages to produce a correct result within the time limit, its reliability increases. And if the processing node fails to produce the result within the time, its reliability decreases. Here, reliability is calculated for each machine on basis of memory, CPU availability.

5) Decision mechanism (DM)

DM selects final output for a computing cycle. It selects the outputs of a node which has the highest reliability among all the VMs. All VMs are those nodes which have produced the results within time limit. If two node have same best reliability level then output of node is selected based upon resource availability there is a system reliability level (SRL). It is the minimum reliability level to be achieved to pass the result. DM compare the highest reliability with the SRL .it must be greater than or equal to SRL. If the node with highest reliability does not achieve SRL then DM raise failure signal and backward recovery is performed. It is done using check ppoint established in recovery cache. And DM also request to some resource manager to remove one node with minimum reliability and add new one.

6) Recovery Cache (RC)

RC is a repository area to hold the checkpoints. Two check points are made after each cycle, one is at TC module and other is at DM module at the end of each cycle.

V. CONCLUSION

Fault tolerance is major key issue in real time cloud computing. And in real time applications, there are more chances of occurring faults or failure because the cloud nodes are far away from user node. In this proposed system good fault tolerance mechanism is used. In this paper the reliability is calculated on basis of correctness, timeliness and resource availability. In future more parameters can be added to it for improving reliability.

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