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EXPLORATION OF FAULT TOLERANCE STRATEGIES IN DYNAMIC CLOUD COMPUTING

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ABSTRACT

Cloud computing is the next generation computing. The GUI which controls the cloud computing makes is directly controlling the hardware resource and application It is the result of evolution of on demand service in computing paradigms of large scale distributed computing. It is the adoptable technology as it provides integration of software and resources which are dynamically scalable. These systems are more or less prone to failure. Fault tolerance assesses the ability of a system to respond gracefully to an unexpected hardware or software failure. In order to achieve robustness and dependability in cloud computing, failure should be assessed and handled effectively. This paper aims to provide analysis of fault tolerance techniques used for fault tolerance in Dynamic cloud environments along with some existing model and further compare them on various parameters.

KEYWORDS: Cloud Computing, Fault Tolerance Reliability, Load Balancing, Replication Proactive, Reactive

I. INTRODUCTION

Cloud computing is the fastest technology today. The number of user are highly increase.. the large scale distributed computing embraces cyber infrastructure and builds upon on the concept in virtualization, grid computing, utility computing, networking, web services and software services to implement a service oriented architecture for reducing information technology overhead for the end-user for provide great flexibility and reduced total cost of ownership and all above on-demand services to a shared pool of computing resources. It has the capacity to yoke the internet and wide area network to use the resources that are available remotely there by to provide cost efficient solution on pay per use basis [1][2].Due to the rapid exponential growth of cloud computing the need of fault tolerance in cloud is an key factor for concern.

Cloud Providers offer services that can be grouped into three categories

A. ***Software as a Service (SaaS):*** The loud application eliminates the need to install and run the application on the customer's own computer, thus removing the burden of software maintenance ongoing operation to the user[10].

B. ***Platform as a Service (PaaS):*** PaaS providers offer a predefined combination of OS and application servers

C. ***Infrastructure as a Service (IaaS) :*** The Cloud service providers provide computers, as physical or more often as virtual machines. Some common examples are Amazon, GoGrid, etc.

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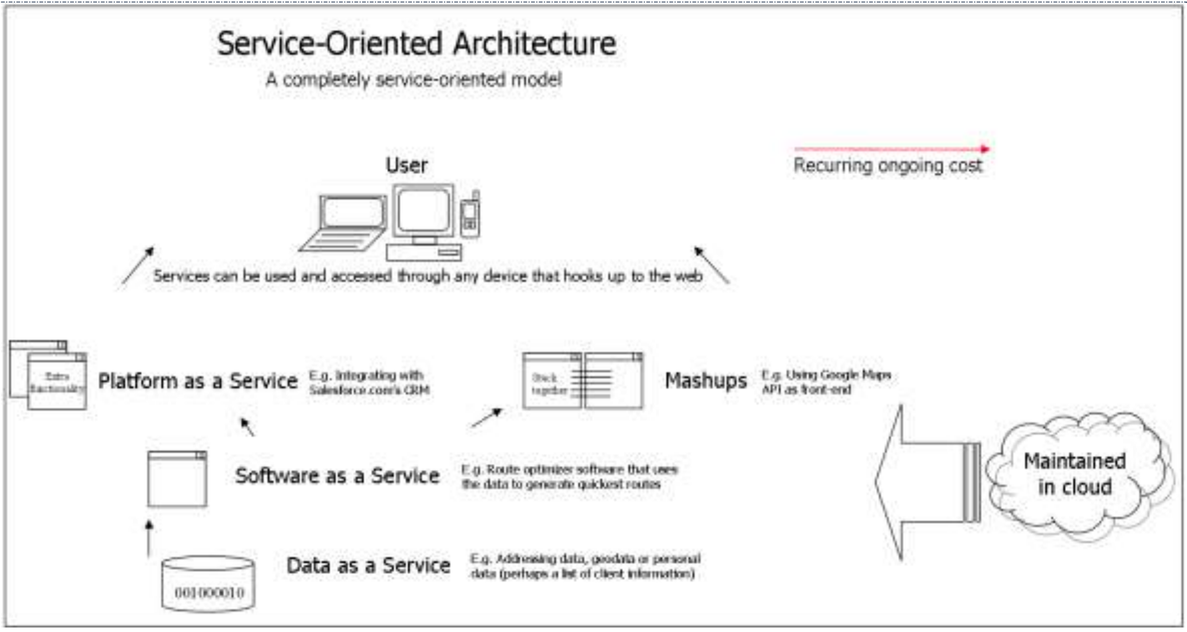

Fig 1:Service Oriented Architecture.

Fault tolerance bear-on with all the inevitably techniques to enable robustness and dependability .The main benefits of implementing fault tolerance in cloud computing include failure recovery, lower cost, improved performance metrics [3]. Robustness leads to the property to providing of a correct service in an adverse situation arising due to an uncertain system environment [4]. Dependability is related to some QOS aspects provided by the system, it includes the attributes like reliability and availability [5]. The motivation of the survey of existing fault tolerance techniques and models in cloud computing is to encourage researcher to contribute in developing more efficient algorithm. This paper is organized to discusses about various aspect of faults and the need of fault tolerance in cloud computing

II. FAULT TAXONOMY AND NEED OF FAULT TOLERANCE IN CLOUD COMPUTING

Fault tolerance aim to achieve robustness and dependability in any system. Based on fault tolerance policies and techniques we can classify this technique into 2 types: proactive and reactive. The Proactive fault tolerance policy is to avoid recovery from fault, errors and failure by predicting them and proactively replace the suspected component means detect the problem before it actually come. Reactive fault tolerance policies reduce the effort of failures when the failure effectively occurs. These can be further classified into two sub-techniques error processing and fault treatment. Error processing aims at removing errors from the computational state. Fault treatment aims at preventing faults from being re-activated [4] [5].Fault tolerance is carried out by error processing which have two constituent phases. The phases are "effective error processing" which aimed at bringing the effective error back to a latent state, if possible before occurrence of a failure and "latent error processing" aimed at ensuring that the error does not become effective again [6] Load balancing is the important concept in network. The load balancer accepts multiple requests from the client and distributing each of them across multiple computers or network devices based on how busy the computer or network device is. Load balancing helps to prevent a server or network device from getting overwhelmed with requests and helps to distribute the work. For example the client can send application request to the server at that time the server over loaded in another process the current process is wait for some time till the serve is idle. Here the client can wait. To avoid this first we check the utilization of the serve and process the client request. The CPU utilization can properly done by load balancing algorithm. The load balancing algorithm which is dynamic in nature does not consider the previous state or behavior of the system, that is, it depends on the present behavior of the system [11].

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III. EXISTING CLOUD COMPUTING

In the existing cloud computing there is no intermediate node like load balancer[13]. The process of the load balancer is to check server utilization if the server has maximum load the request is transfer to another server and identify the reliable server to process the client request. If the load balance is not available the client can wait for long time and process their request in the particular server only where the client give request. The existing the cloud use the following technique instead of load balancer[14][15].

A. *Self healing*: Maximum human interaction. Use certain rules.
B. *Job migration*: During the time of failure the job is migrating into another server.
C. *Replication*: The same data is stored in different place. Replication-Various task replicas are run on different resources, for the execution to succeed till the entire replicated task is not crashed. It can be implemented using tools like HAProxy, Hadoop and AmazonEc2 etc.
D. *Static load balancing:* Only fixed capacity of the data is transfer. There are many drawbacks in above four methods. To overcome this drawback the cloud computing use intermediate node in the recent days[8][9]
E. Check pointing–It is an efficient task level fault tolerance technique for long running and big applications .In this scenario after doing every change in system a check pointing is done. When a task fails, rather than from the beginning it is allowed to be restarted that job from the recently checked pointed state.
F: Software Rejuvenation-It is a technique that designs the system for periodic reboots. It restarts the system with clean state and helps to fresh start.

Fig 2: ***Cloud without intermediate node***

IV. PROPOSED IN CLOUD COMPUTING

In proposed method the dynamic cloud computing environment is used, The intermediate node is used to monitor the load of each VM in the cloud pool. In this approach the user can send the request to the intermediate node. It is responsible for transfer the client request to the cloud. Here, the load is consider as in terms of CPU load with the amount of memory used, delay or Network load[16].

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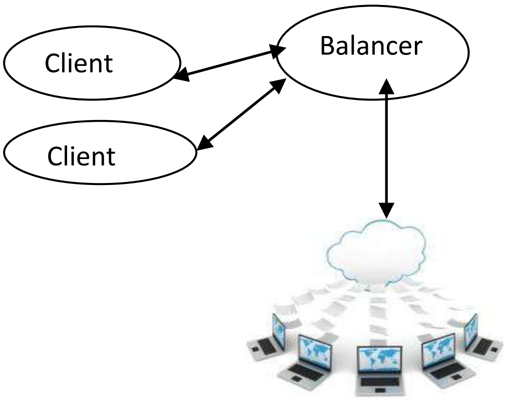

Fig 3: Cloud with intermediate node

Load Balancing Algorithm The VM load balancing algorithm is used to balance the load in the cloud pool. This algorithm check the CPU utilization depends upon the request ***Input:*** Cloud, VM nodes, Task and allocate the server to the client[12].

Output: Solution(s) i.e.Task Completion without Fault

Begin

```
    for each VM: n, n1, n2... ni Node utilization u(ni) = 0; Memory m(ni)=0;
    do for each cloud c1, c2…ci
     do Select VM node (n)
            end
     end
     do
            Select task Rand(t)
            Allocate to cloud Ci <-- ti
             Calcultate U(ti) && M(ti)
            Calculate U(ni)&& M(ni)
    if U(ti) < U(ni) && M(ti) < M(ni) && U(ni) < 75% && M(ni)<75%
            do allocate task to VM
    end
    if any fault(f) occurs
             do while task completes
            do Switch VM
            go to if U(ti) < U(ni) && M(ti) < M(ni) && U(ni) < 75% && M(ni)<75%
             Allocate task (ti)
    end
            return solution(s);
            end
```

V. METRICS FOR FAULT TOLERANCE IN CLOUD COMPUTING

The existing fault tolerance technique in cloud computing consider various parameter. The parameters are like there type of fault tolerance (proactive, reactive and adaptive),
performance, response-time, scalability, throughput, reliability, availability, usability, security and associated over-head. Table 2 summarized the Comparison among various
models based on the metrics element.

Proactive fault tolerance: The Proactive fault tolerance policy is to avoid recovery from fault, errors and failure by predicting them and proactively replace the suspected component means detect the problem before it actually come

Reactive fault tolerance: Reactive fault tolerance policies reduce the effort of failures when the failure effectively occurs. This technique provides robustness to a system.

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Performance– This is used to check the efficiency of the system. It has to be improved at a reasonable cost e.g. reduce response time while keeping acceptable delays.

Response Time - is the amount of time taken to respond by a particular algorithm. This parameter should be minimized.

Scalability–This is the ability of an algorithm to perform fault tolerance for a system with any finite number of nodes. This metric should be improved.

Throughput–This is used to calculate the no. of tasks whose execution has been completed. It should be high to improve the performance of the system

Overhead Associated: determines the amount of overhead involved while implementing a fault tolerance algorithm. It is composed of overhead due to movement of tasks, inter-
processor and inter-process communication. This should be minimized so that a fault tolerance technique can work efficiently

VI. RESULTS AND DISCUSSIONS

In proposed method we take two VM for test. We check the CPU usage and the memory usage of the two VM and we identify the reliable VM which contains less load and high memory can process the client request. The balancing section is responsible for determining where virtual machines will be instantiated. It does this by first gathering the utilization percentage of each active compute node. In this algorithm the load balancer node check the CPU utilization if the CPU is less than 75% utilization the request accepts otherwise VM load balancing Algorithm instantiates a new virtual machine on the compute node with the lowest utilization number[17] The algorithm is to identify the reliable VM and process the client request. For that the algorithm cerate cloud pool. The cloud pool contain the VM.

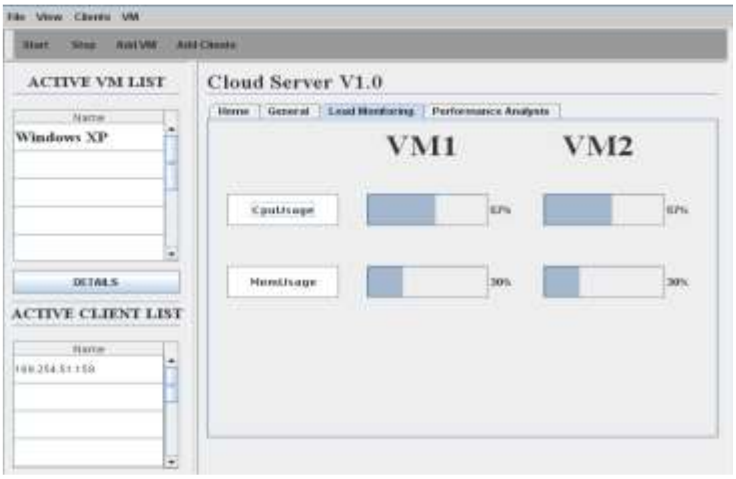

*Fig 4: **The Comparison of Two VM***

The above Fig 4: we find the CPU and the memory usage. If the memory and the CPU has reliable to process the request that VM is selected from the cloud pool. First the client request is sent to load balancer. The load balancer can send that request to cloud pool with the use of client IP address.

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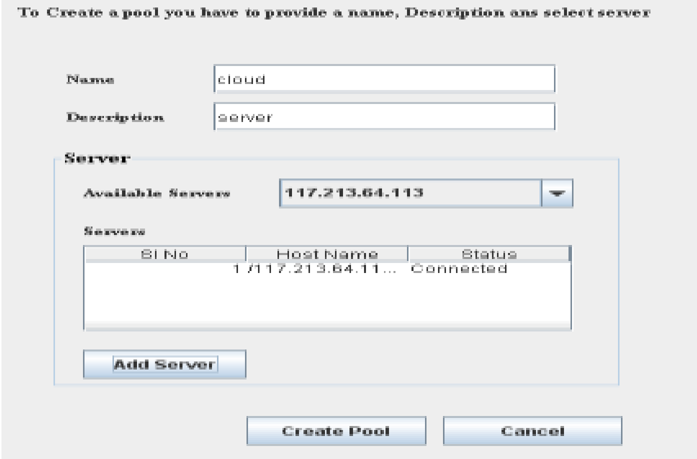

Fig 5: The Creation of cloud VM

The cost analysis of the load balamcing cloud computing is very efficent and improve the time. The VM payload barrier load balancing algorithm is effcent algorithm in VM cloud.
The performance analysis of the load balancing gives the high throughput and increase the performance

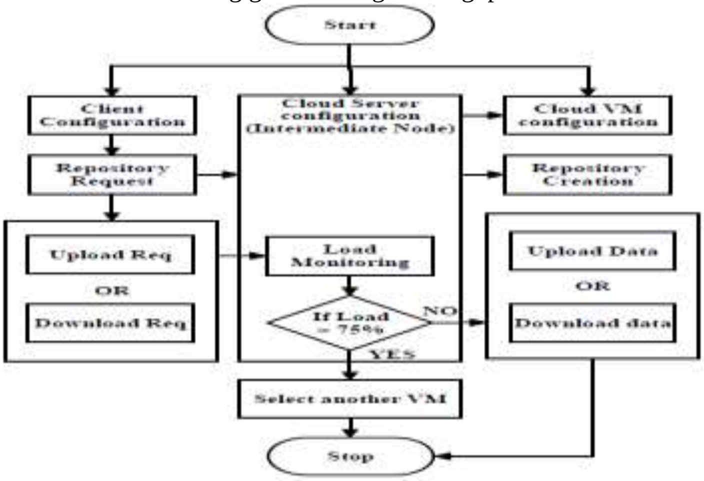

Fig 6: Proposed method flow

- High scalability
- Dynamic load balancing
- Fault tolerance
- Low overhead

In proposed cloud computing the VM monitoring systems can achieve the following concepts[18]
 High scalability: The scalability in cloud computing refers to increase the number of clients request with simultaneous request can perform better without fault.

 Dynamic load balancing: The dynamic load balancing refers to the client can upload or download the document for the cloud server without any specific memory capacity. The intermediate node will check the CPU and the memory usage. If the CPU usage is above 75% the client will process otherwise the client request will go to next available VM.
 Fault tolerance: The fault in cloud can reduce with the use of dynamic load balancing algorithm. The load balancing algorithm checks the CPU utilization and loads the request.
 Low overhead: Setup an alternate computer or network device that can be used as an alternative access point or can share the load through a load balancing.

VII. CONCLUSION

Fault tolerance methods come into play the moment a fault enters the system boundaries. So theoretically fault tolerance techniques are used to predict these failures and take an appropriate action before failures actually

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occur. in this approach can automatically monitor the load balancing with the use of load balancer The data replication, job migration and the static load balancing is avoid in our method. The CPU and Memory can be utilized properly and identify the reliable VM in the cloud pool. there are number of fault tolerance models which provide different fault tolerance mechanisms to enhance the system. But still there are number of challenges which need some concern for every frame work or model. There are some drawback no one of them can full fill the all aspects of faults. So there is a possibility to overcome the drawbacks of all previous models and try to make a compact model which will cover maximum fault tolerance aspect.

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