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# A Study on Adaptive Fault Tolerance in Real Time Cloud Computing

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***Abstract : The biggest buzz in the computer world is Cloud Computing. To different people cloud computing means different things. Cloud computing may be defined as management and provision of resources, software, application and information as services over the cloud or internet and demand. Cloud infrastructure provides great potentials in low cost and on demand services for both commercial and non-commercial clients. Now day's real time applications also take advantage of computing capabilities and virtualization of cloud computing for their execution. As most of the real time applications are safety critical and are reliable so the requirements of fault tolerance increased achieve reliability. So in this document a model is discussed which tolerates the fault and makes the decisions on the basis of reliability of the processing nodes which are also called virtual machines. As the reliability of the processing nodes is adaptive that's why the name of the model is REFASHIONING ADAPTIVE FAULT TOLERANCE IN REAL TIME CLOUD COMPUTING. If a virtual machine produces correct result and on time then its reliability increases otherwise vice versa. But if any of the node does not achieve the level than backward recovery is performed by the system. Basically here the system provides both forward and backward recovery. The main focus here is adaptive behavior of the processing nodes and removal or addition of the nodes on the basis of the reliability.***

***Keywords : Cloud Computing, Fault Tolerance, Virtual machines, Reliability***

## 1. INTRODUCTION

In today's life everyone relay directly or indirectly over internet the most common example are websites like Gmail, Yahoo, facebook which receives millions of clicks everyday. This results in the generation of terabytes of invaluable data. So all high-end applications commonly need real time capturing, storage and analysis of this data.

To overcome such problems different cloud computing technologies has been stated developing from last few years. Cloud computing is a different style of computing where dynamically scalable and virtualized resources are provided as a service over the internet. The cloud refers to the datacenter hardware and software that supports a client's needs, often in the form of datastores and remotely hosted applications. [1]

Although cloud computing has been widely adopted by the industry, still there are many research issues to be considered like fault tolerance, workflow scheduling, workflow management, security etc. Fault tolerance is one of the key issues amongst all. Many techniques are adopted for fault tolerance. When a fault occurs, then techniques provide mechanisms to the software system to prevent system failure occurrence. The main benefits of implementing fault tolerance in cloud computing include failure recovery, lower cost, improved performance metrics etc. It is heavily based on a more traditional technology: grid computing, which has been researched for more than 20 years. Basically Cloud computing focuses on the sharing of information and computation in a large network of nodes, which are quite likely to be owned by different vendors/ companies. It is believed that cloud computing has been one of the sources for success in several major companies such as Google and Amazon. Cloud computing is expected to be the platform for next generation computing, in which users carry thin clients such as smart phones while storing most of their data in the cloud and submitting computing tasks to the cloud.

Overall, cloud computing brings the following three new aspects in computing resource management: infinite computing resources available on demand for the perspective of the end users, Zero up-front commitment from the cloud users, And short-term usage of any high-end computing resources [2],[3]. When a client submits computation tasks toward the cloud, security of such computation naturally becomes a great concern. This is mainly because the data leave the client and the computation results will be returning from the cloud, which are usually considered out of the client's control. Computation security has many perspectives.

 

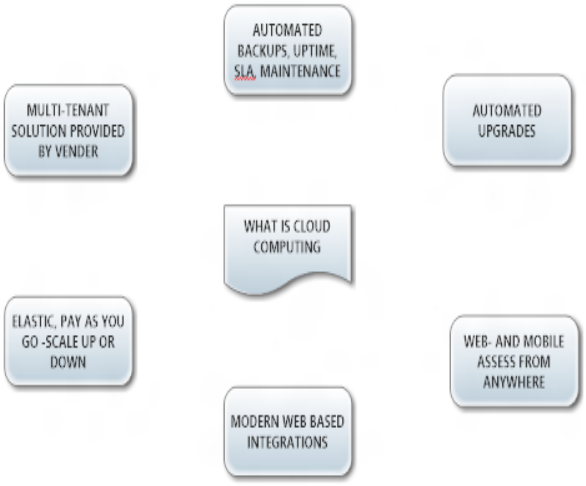


Fig-1 cloud computing [5]

## 2. LITERATURE SURVEY

**Sheheryar Malik and Fabrice Huet Research Team OASIS in Adaptive Fault Tolerance in Real Time Cloud Computing presented a fault tolerance model for real time cloud computing.**

In this research paper a model is proposed named Adaptive fault tolerance in real time cloud computing. In this model the system tolerates the fault and makes the decisions on the basis of reliability of the processing nodes named virtual machines. After every computing cycle the reliability of virtual machines changes that's why it is adaptive. But if a virtual machine manages to produce a correct result within the time limit than the reliability increases but if it fails then the reliability of virtual machine decreases.

For the reliability assessment a model is given named metric model. In the model, the reliability decrease more than increase. Due to such reason the node fails continuously then that node will be removed and new node will be added. The whole technique is based upon the execution of design diverse variants on multiple virtual machines and assigning reliability to the results produced by the variants.

For the fault tolerance of all real time applications that are based upon cloud is AFTRC adaptive fault tolerance in real time cloud computing. On the basis of reliability the virtual machine is selected for computations and if it doesn't perform well then it is removed.

There are two types of nodes one is set of virtual machines running on cloud infrastructure and the second is adjudication node and this node can be the part of user infrastructure or user infrastructure.

To execute all real time applications we have N nodes and all the nodes are the virtual machines that run the invariant real time applications algorithms. Basically the virtual machines replicas of each other.

In the given model there are N nodes or virtual machines which run individual invariant algorithms. After that there is a module named AT acceptance test which is attached to each virtual machine and is responsible for verifying the output. Than the output is passed to next module named TC time checker which checks whether the result is produced within time or not. If yes, the result is passed to next module otherwise not. If all the nodes don't produce the result in time than backward recovery is applied. Now, on the basis of the result produced by TC the RA reliability assessor calculates and reassign the reliability to each module. RA is the main core module of the whole system. The system tolerates the faults and decisions are made on the virtual's machines reliability and the reliability changes after every computational cycle. There is also a minimum and maximum reliability level which depends on the real time applications and user decide itself that how much be the minimum and maximum reliability value. Now if the reliability of any node falls below the minimum reliability level than the RA stops that node and removes it and then add a new node in the place of the removing node. But handling and removing procedure is not the task of RA it calls the resource manager to handle these tasks. Here proactive resource manager works and removes the node that's reliability is below the minimum reliability.

If the reliability of all the nodes falls below the minimum reliability level than backward recovery is performed. Now the output is passed to the next module DM decision mechanism.DM will select that node which has highest reliability among all the other competing nodes. There is a SRL (system reliability level) it is the minimum reliability level which each node has to achieve to pass the result. Now the DM make the comparison between the best reliability and the system reliability and the best reliability should be greater than or equal to the SRL. But if this condition has not been achieved than DM raises the signal that the system fails in this case backward recovery is performed and this recovery is performed with the help of RC

 

recovery cache. DM also requests the resource manager to remove that node which has minimum reliability level and add a new node in its place.

Recovery cache (RC) is a repository that holds the checkpoints. After each computing cycle DM maintains the checkpoints in it. Backward recovery is performed by the checkpoints. In this system communication induced checkpoints are used which perform the check pointing at the end of each cycle.

An automatic forward recovery is provided by this scheme. If any node fails to produce the output after the time overrun then the system will be considered that it fails else it will continue with the remaining nodes. This mechanism is very beneficial because it will produce the result until all the nodes fail.

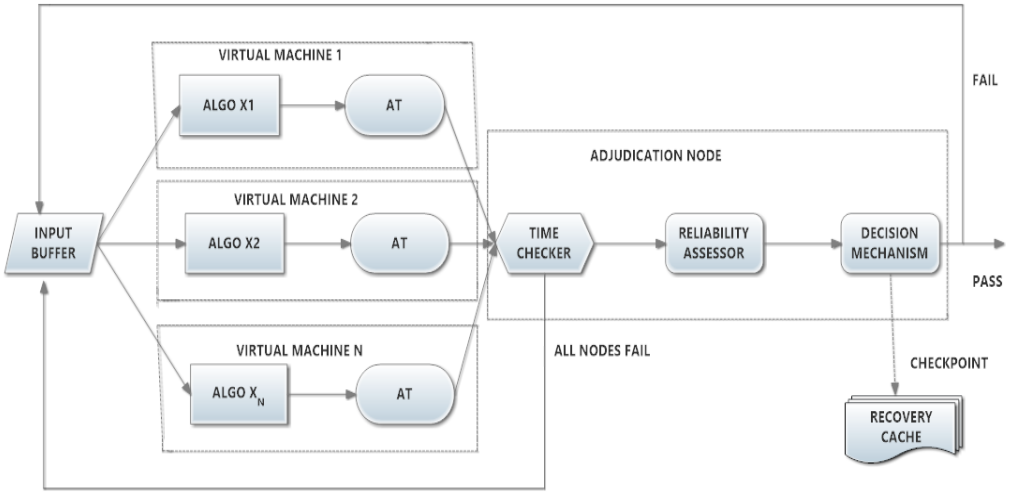


Fig-2 Adaptive Fault Tolerance in Real Time Cloud Computing [4]

## 3. CONCLUSION AND FUTURE WORK

The AFTRC is a very good option to be used for the fault tolerance in all real time computing applications. This is highly fault tolerant. This kind of system takes advantage over the dynamic scalability of cloud infrastructure that's why using the adaptive reliability method. And also in this case there is less chances of failure. The main advantage of this scheme is that because of the checkpoints which are made in the end when all the nodes have produced the result this will not cause domino effect.

Some new enhancements can be made on this model. The main focus is to include more reliability factors on which ecisions are to be made and it will be more effective. Also one resource manager is working i.e. proactive resource manager we can also use reactive resource manager which will not remove the node but try to resolve the problem which causes node failure.

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