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Original Article

Enhanced Fault Tolerant Cloud Architecture to Cloud based Computing using Both Proactive and Reactive Mechanisms

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Abstract -Fault isolation is one of the essential issue in the arena of cloud based computing. Many earlier approaches or mechanisms or techniques are allowed a system to tolerate the faults when the faults are encounter during its operational or functioning. Fault isolation is one of the essential areas of research due to its complexity. Here observing the mainly reliability and availability issues in current cloud providers hence required the most effective solutions. in this paper proposed an enhanced cloud fault tolerant architecture combining of both proactive and reactive approaches. Both approaches can run parallel and calculate the reliability and availability measures. Considering the both reliability and availability measures identify the most important trust worthy virtual machines for the next cloud data centers. Those kind of trust worthy virtual machines will helps in day to day transactions will monitor the faults so that it will increased the reliability and availability measures with less numbers of faults. the above proposed enhanced fault cloud architecture is highly scalable and reliable [2][21].

Keywords -Fault isolation, Cloud based computing, Reliability, Availability, Fuzzy logic, Fuzzy Genetic Algorithm, Effective data sharing.

1. Introduction

Fault isolation is one of essential method for the system endures to achievement even if there is a fault [1]. Fault isolation stands a foremost anxiety to reliability and obtainability of any facilities as healthy as the system execution. Failures or faults should be handling efficiently while the application executions any faults are occur. Many existing fault isolation approaches are discussed in the paper but still fault isolation is one the challenging area in cloud based computing. the basic technique to reach the fault isolation is the copying of virtual machines. in this paper proposed and designed enhanced fault tolerant isolation architecture using both reactive and proactive techniques. This architecture helps to reduce the checkpoint overhead and speed of recovery from failures and faults. These approaches may be implemented in either task level or workflow level. We will get the results with proactive and reactive techniques with increased fault isolation results load balancing solutions. the comparative study is explains the experimental results of reliability and availability with increased fault isolation results [2].

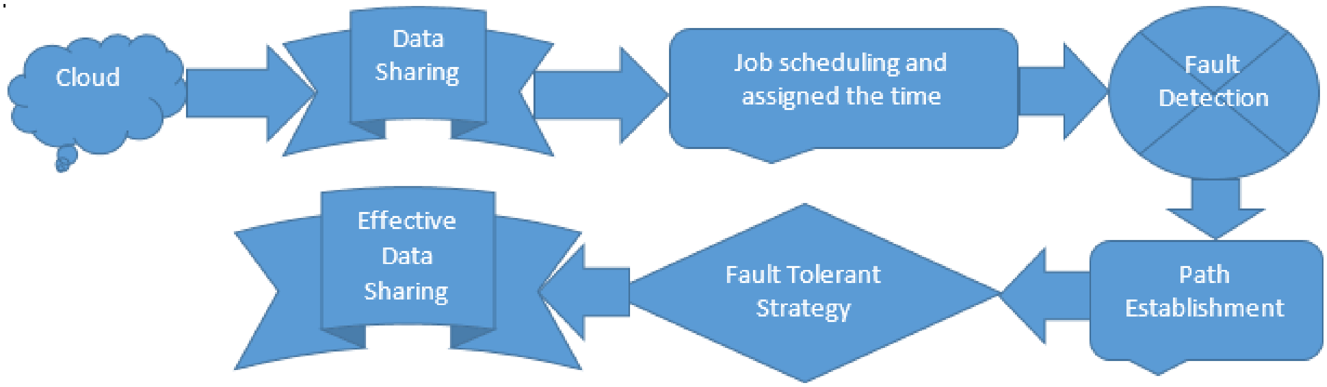

Fig. 1 Effective data sharing architecture

2. Related Work

In this segment, will discuss the past work on the refining strategies of cloud based computing. There are various techniques are designed as a solution in order to minimize the number of checkpoints and recovery cost. Those checkpoints strategies are calling as a Fault tolerant or isolation strategies.

Author proposed a distance aware checkpoint mechanism. This will do here like storing the checkpoint image on the server in ungraceful manner. There are two kinds of servers like small storage space server and large storage space server. Large storage space server is having more checkpoint images for recovery when fault identified in any of the virtual machine. Server selection is based on the resources availability other than storage. This is one way to resolve the fault issues [4].

Author proposed a distance aware checkpoint mechanism with broker. This mechanism helps to reduce the checkpoint prosecutions required to recover the progress made through the VM. Cloudlets is monitored the faults through the broker. This kind of uncoordinated checkpoint approach is handles with less trials and more fast recovery. Here mainly virtual machine is will be acting as a checkpoint point server whenever required [2].

Next Author proposed an optimal checkpoint method is introduced with the help of edge switch failure aware checkpoint algorithm. This is having two steps of algorithm, first step is taken care of topology communication and server selection, second step is as the topology available for communication to select the recovery server. This gives the advantage like sorting of numbers of virtual machines search is less for recovery server selection process [21].

Checkpoint of non-blocking is a mechanism of local checkpoint process. Local checkpoint process may live on in transit and stray message. When taking checkpoints snapshots the processes not needing discontinuing their execution. Limitation of this approach is foil the process from receive an application message that would result is unreliable message.

Global checkpoint approach is a mechanism to implement of global checkpoint. All the global checkpoints formed and identify the failure tasks and to resolve the failures. Global checkpoint approaches will helpful to provide definitive progress solutions. We will get the better results from Global checkpoint approach when compare to local checkpoint approach [5].

Author suggested a task scheduling optimization for the cloud based computing using Fuzzy Genetic algorithm. It will make the scheduling decisions by calculating the entire assembly of tasks in a queue. Here for each objective designed the scheduling parameters and satisfaction grades. Fuzzy Genetic algorithm is designed on a task level scheduling in Hadoop Map reduce. This approach will gives the balanced load finishing time of tasks allocated to the processors and also takes the optimum decision over the collective group of tasks [6].

Author proposed a empirical algorithm to put on ant colony optimization approach for the distributed service allocation and scheduling algorithm in cloud based computing environment. The suggested optimization algorithm is reduced the arrangement throughput to service all distributed demands according to different resource allocator available under cloud based computing environments.

Author proposed a public cloud storage model for small-to-medium scale technical societies to consume effective resources on a public cloud site. On top of this implemented the innovative system called Dawning cloud. This will helpful the light weight service managing layers running on a mutual management overhaul framework. This Dawning cloud saves us the resource utilization to supreme quantity.

Author proposed an approach to refine the QOS of actual world budget and to spread and enhance the simulator of cloud based computing of cloudsim by using mart algorithms and inherited from Gridsim simulator. These efforts fulfills the users by reducing the charge of processing cloudlets and enhanced operation on Gridsim to decreases the time of silent mart and assure a fast and effective gaining of totaling resources [7].

Author proposed a resource scheduling algorithm based on a GA algorithm to design the finest load balancing and reduces the dynamic migration. As part of overall load balancing effect of the algorithm added an average load distance technique. This method will helps to resolves the load imbalance issues and reduces the migration cost by using the virtual machines scheduled based on the requirement [24].

Author designed a peer-peer model environment. It uses the variability of parameters, procedures, plans and guidelines to be changed and studied. The POC of the simulation environs is presented in a large scale distributed system problem and it includes the core model and linked mechanisms to resolve the issues.

Author proposed a communication aware load balancing technique. It is talented of refining the enactment of communication through applications and that is possible by utilizing of networks in cluster environments. When parallel applications need to communicate and load balancing technique should be added and also large requirements of Network, CPU, Memory and disk I/O resources.

Another Researcher examined the problem of scheduling workflow applications on grids He was implement the novel scheduling algorithm to reduce the application execution time. The production of grid resources deviations vigorously and get the correct the performance is challenging and implement the rescheduling mechanisms to able to get the expected performance results effectively [9].

Another Researcher proposed a compromised time cost scheduling algorithm. It think through the features of cloud based computing to provide the accommodations instance intensive cost constrained workflows. These workflows will negotiating the execution time and cost with the user enabled on the spot. This algorithm can achieve a lower cost when compare to other algorithms. it will meet user designated deadline or reduce the mean execution time when compare to other algorithms and reduces the execution time cost.

Researcher proposed a data replication algorithm and it is provide the hypothetical performance guarantee and also applied in a spread manner. This is based on a polynomial time centralized replication algorithm. This algorithm will decreases the half of the time of total data file access delay and it is an optimal replication solution [20].

Checkpoint approach saves the reckoning time for the faulty tasks and also some dynamics like runtime overhead, latency and recovery. the recovery delay is the time of download of any unsuccessful tasks. Check point from the check point server to the cloud resources where the tasks are rescheduled to run [21].

The below architecture explains the effective data sharing process when fault detection happened and introduces the fault tolerant strategy. Here we are focusing on mainly a check point based mechanisms for fault isolation solutions [10].

3. Check Pointing System

Check pointing system is mainly working on the change in a system in a regular intervals of time whenever failures occur. If the job failure occurs, we have to restart the job at a recent check point state. Check pointing system is categorized as 2 one is full checkpoint and second is incremental checkpoint.

3.1. Full Check Pointing System

Check pointing system can be applied at a successively process after a static time interval and capture the process state in any one of the location. If any procedure fails during the implementation then perform the operations on the last saved checkpoint.

3.2. Incremental Check Pointing System

This Incremental Check Pointing system aids in reducing the checkpoint overhead by saving those dirty pages. in this process we won't save the whole process and only save the wherever the changes made [19] [18].

4. Proposed Architecture

4.1. Check Point based Fault Isolation Architecture

This mechanism helps reduces the re-compuation time evidently & successfully. This Check Pointing system mainly take the screen print of current state of running server. When application need to start from latest checkpoint state when failure is occur.

4.2. Fault Identification Approach

Prior work is not focused on VM failure that arises due to many factors like upper response time of a node, attacker fault and performance fault as well and also prior work is not concentrates on the optimization approaches at the recovery phase.

To refine the reliability and availability, combining of the both proactive and reactive methods designed a new model for an effective broad architecture. in this paper mainly proposed a new fault management mechanism. This fault management mechanism is having two steps [11][12]

Step 1: The heartbeat protocol is castoff to check if a copy set is collected of VM clusters is alive or not.

Step 2: If any fault is detected, fault recovery mechanisms are executed which are composed of checkpoint/recovery, job migration and restart.

The above approach identifies the faults in other way that is prediction of faults. If a job is executed in virtual machines, we received a result either pass or fail. When the result is received a pass then reliability factor increases and availability of virtual machines trust also increases. When the result is received a fail then reliability factor decreases and availability of VMs trust also decreases. We will consider the above two factors – reliability and availability of performance then decide if we need to change the replica set. This process will take care of the replication manager. Replication manager may observe the more failure due to the above reliability and availability factors results. The above heart beat protocol will helps to enhance to overcome the failures and observers to enhance the reliability and availability. We can configure the new replica set of Virtual machine clusters in the system and calculate the reliability and availability results using heartbeat protocol. This same process will continue to identify the trust virtual machines and those kind of trust virtual machines helps reduces the number of failures and faults. We will implement this architecture many of the existing architectures. Those things will helps to increase the error tolerance and load balancing when error occurs [2] [22].

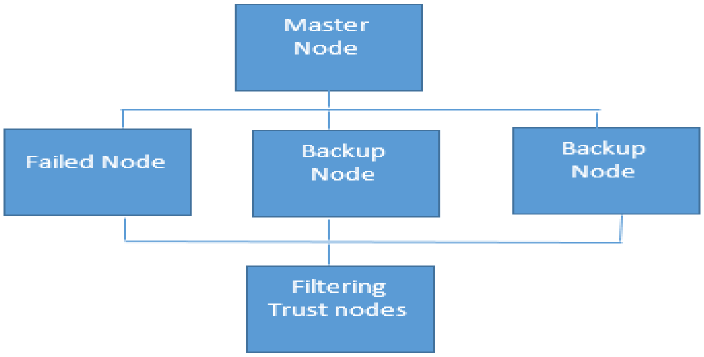

Fig. 2 Trust VM identification architecture

4.3. Development and Deployment

Enhanced cloud fault tolerance architecture contains two types fault handling mechanisms. That is both reactive and proactive. Both approaches should be run parallel on different processes to identify more faults and increases the more fault tolerance solutions.

Reactive Fault tolerance approach is perform the fault discovery and three levels of recovery mechanisms are available. Our new enhanced cloud fault tolerance architecture observers the each cloud nodes by using the heartbeat protocols via the fault detector when the VMs are alive or not. If incase of any fault detected then introduces the fault recovery system. That fault recovery system tries to repair the fault by running the fault tolerance techniques like check pointing mechanism or recover mechanism, job migration and restart mechanisms.

Proactive Fault Tolerance approach is works based on the reliability and availability factors. As part of reliability process implements the fault isolation protocol. The virtual machine cluster and fault indicator rigorously feed the replication manager based on success or failures of services running on the virtual machine. If any of the virtual machine reliability goes below to the least reliability then replace the virtual machines before observers the faults. With this way increases the fault tolerance results and enhance the reliability and availability of results [22].

The above two approaches should be run parallel and increases the reliability and availability in the real time architecture. We are observing the effective results when compare the any existing approaches.

The enhanced fault tolerance cloud architecture have the below **eight components.** Those components are

1. Cloud Worker Interface

2. Fault verdict maker

3. Fault finder

4. Fault handling mechanisms

5. Virtual Machine replica cluster

6. Replication manager

7. Identification of Trust virtual machines to implement the same

8. Recommendation set of virtual machines

4.3.1. Cloud Worker Interface

Number clients are configure automatically. With the help of automatic configuration reduces the human errors. If any faults are detected then proceed with the recovery protocols to resolve the issues.

4.3.2. Fault Verdict Maker

If any faults are detected and notified to handle fault decision maker to executes fault handling unit. There are many fault handling components are available to provide fault tolerance solutions. Those are replication manager, checkpoint/recovery manager, job migration manager or restart manager. Fault decision maker will forward the faults to all the modules present. Fault decision maker launches recovery module. Fault recovery module executes the check point/recovery mechanism, job migration and restart mechanisms. Those mechanisms changes the replica set.

4.3.3. Fault Finder

Replica set is going to place in master and back up nodes. The heartbeat protocols executes in the master and backup nodes. We will not get the response in the specified time interval then will consider the virtual machine is dead and resume the process with other replica set of virtual machines.

4.3.4. Fault Handling Mechanism

The three mechanisms are checkpoint/recovery, job migration and restart mechanisms are resolves the above faults and provide the effective solution. Replication manager removes the replica set and places the new replica set to start continue the execution.

4.3.5. Virtual Machine Replica Cluster

Replica cluster is having one master node and three back nodes. Master nodes sends heartbeat messages to the all back nodes and get the response from them.

4.3.6. Replication manager

Replication manager is having different replica sets. One replica set is having the less reliability computation results hence replace the replica sets with new replica sets to get the more reliable and availability results information. These will helps to provide increased fault tolerance results.

4.3.7. Identification of Trust virtual machines to implement the same

We will calculate the reliability and availability results based on the pass or failure mechanisms for the virtual machines. Identify the more reliability virtual machines based on pass or failure. Select the more reliability nodes as trust virtual machines. Those kind of trust virtual machines are involve under data sharing process. This will gives more accurate results without any faults. The same kind of trust virtual machines becomes reputation virtual machines after few transactions based on the real time results.

4.3.8. Recommendation Set of Virtual Machines

These recommendation sets of virtual machines will helps to achieve the more reliability and availability of services to users or customers. This will gives the guarantee without job failure in cloud based computing system [15] [16].

5. Evaluation Results

In this segment the efficiency measure was evaluated to provide the performance of proposed enhanced cloud fault tolerance mechanism. The efficiency of framework was evaluated in terms of reliability and availability value. The reliability valuation, decision making was valuated based on these measures. We are using the acceptance module to monitor the correct results of information. The timing of outcome shaped by each VM will be watched using watch dog software. Amazon elastic cloud and Microsoft azure are both rental based cloud infrastructures to achieve the replication technique.

Amazon web service provides the platform for the fault tolerant systems and also provides the possibility to implement the enhanced cloud fault tolerance architecture. That designed new cloud platform which monitor and identify the faults and calculated the reliability values. Those reliability values are represents in the form pass or fail. According to reliability values if there is less reliability values changes the virtual machines cluster to process to identify high reliability virtual machines for providing effective data sharing solutions. With this simulator possible to calculate the reliability value of each virtual machines and identify the most trusted virtual machines.

Table 1. VM name & reliability value

VM Name	Reliability Value
Virtual Machine1	4.3
Virtual Machine2	2.5
Virtual Machine3	3.5
Virtual Machine4	4.5

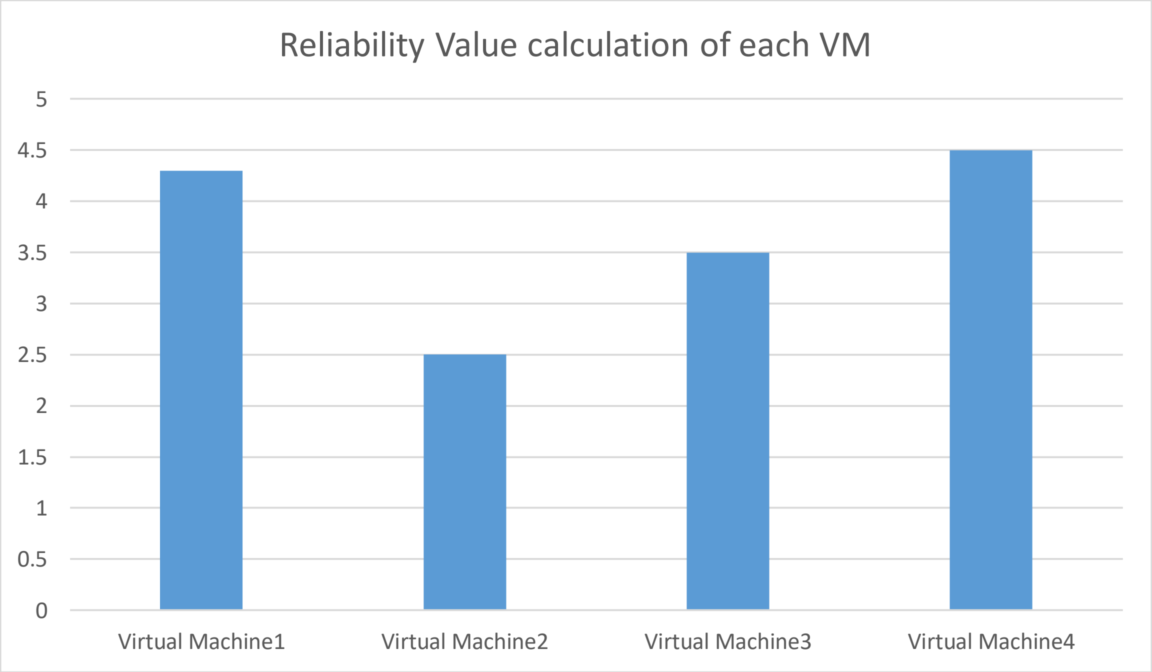

Fig. 3 Reliability value calculation of each VM

The above chart represents the reliability value calculation of each VM. With this approach identifies the more reliable VM, those things are helpful to provide the trust based solutions in cloud computing environment. When compare to existing to proposed system may observe the increased fault tolerance results and load imbalance solutions.

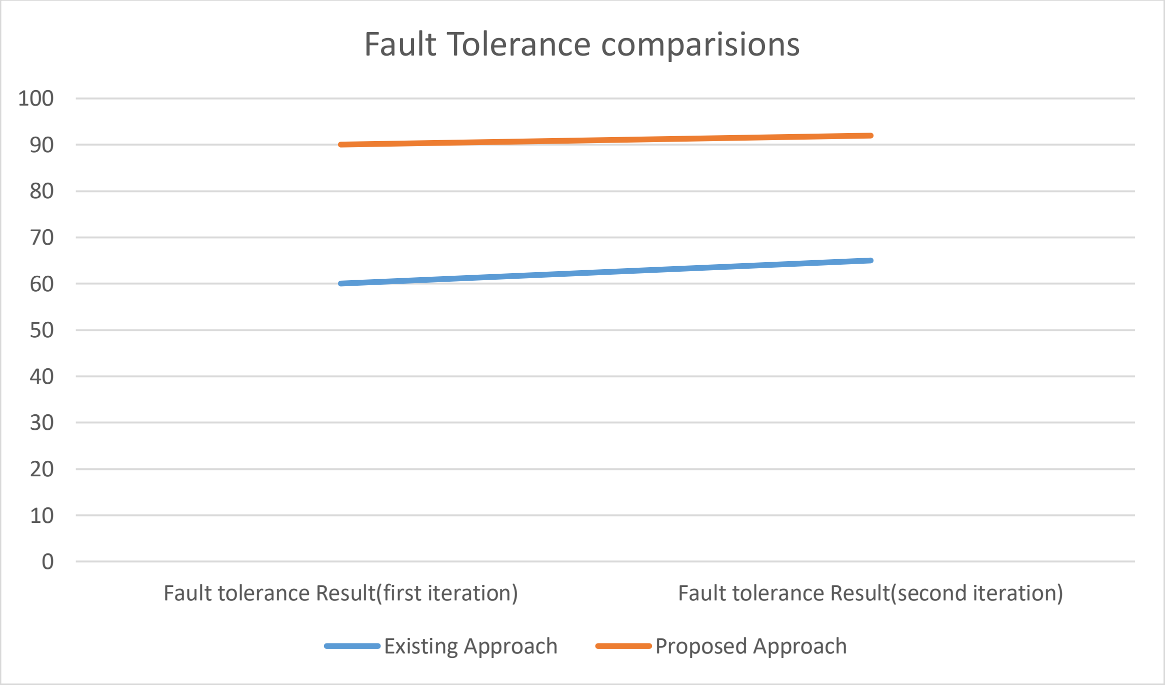

Fig. 4 Fault tolerance comparisons from existing and proposed approach

The above chart represents the comparison of fault tolerance results from existing to proposed approach. We could see more fault tolerance results are received from proposed enhanced cloud fault tolerance architecture.

6. Conclusion

Reliability and availability are most important requirements for cloud based computing solutions. Fault tolerance techniques are one of the most important techniques for the system is working when fault or failures are occur. In all the existing approaches or mechanisms observes and there are concerns like still some faults or failures are there. In this paper proposed enhanced cloud fault tolerance architecture with combining of proactive and reactive techniques to work parallel runs. This approach helps to minimize the check points for effective data sharing.

7. Future Work

By guessing the happening of the fault in advance using support vector machine and machine learning algorithms and isolating it by load balancing techniques will harvest the better performances.

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