ISSN:0975-9646

A Replica Distribution Based Fault Tolerance Management For Cloud Computing

Ajitabh Mahalkari, Prof. Ritu Tondon

Department of Computer Science & Engineering
TRUBA college of Engineering and Technology, Dewas bypass, Indore (M.P) -452001 India

***Abstract*: Cloud computing now a day's become most popular and reliable computing technique for organizations and individuals. In the cloud environments, data availability and backup replication are critical and complex issues in the an efficient fault tolerance policy is the major. Fault tolerance policy is the strategy in action when a fault occurs in the system. Taking backups is the one of the most usual solution of keeping the data safe out of these faulty conditions, But sometimes traditional schemes and backup servers might get into bottleneck conditions due to their replica management schemes. CSP has to adopt a fault tolerance policy to ensure continues delivery of services. There are two main categories policies that are proactive and reactive fault tolerance, both have different advantages in different situations. Our research introduces a new approach as a fault tolerance policy, which is having characteristics of both the above mentioned policies. In our approach replica distribution and retrieval is the functional areas.**

***Index Terms*:** Cloud Computing, Fault Tolerance, CSP, Replica,

I. INTRODUCTION

Cloud computing is modern computing model based on on-demand services. For organizations to be competitive in frequently changing market and highly interconnected global economy, they need to be capable enough to be able to respond rapidly to the changing market. A cloud, a next level computing model, provides amazingly scalable and flexible computing that is available on demand. Cloud Computing facilitates self-service requesting through a user friendly interface.

Cloud Computing promises real costs effective and agility to organizations. Cloud computing serves the demands of a number of individuals and organizations. Demands may be higher end services, data or any other computing resources. Consumer needs are varied and challenging to full fill. Customers do not likely to bear service downtime and data unavailability without keeping technological challenges in mind. Customer needs include high performance and data availability. Fault tolerance is a major concern to the service provider to assure availability of data and continuity of services.

Failures should be anticipated and handled proactively or reactively according to the service and the level of agreement with the consumer. Fault tolerance techniques are used to predict these failures and take appropriate precautions, or remedial actions before failures can actually occur. Effective and efficient fault tolerant techniques are need of cloud computing. We are trying to introduce a combination of proactive and reactive fault tolerance policy in this paper.

Data loss occurs for different reasons reduce availability of the data and retrieval causes degradation in reliability and authentication over the system. To deals with such issues cloud computing needs an effective storage and retrieval policy requires dedicated fault tolerant mechanism which makes the system robust and safe. These legacy fault models distribute the loads among the various nodes and processing routine execution time reduces dynamically.

Every methodology would work according to their reliability of operations. Successful data backup and retrieval of data after faults eventually increases the system reliability and decreases after crash or unavailability. The reliance, values changes after each computing cycles and measures the behavior of the system. The process of assigning the reliability values for system is a time based approach in which the maximum or minimum reliability decides the kind of data backups required. Thus it can be considered as a key decision making approach for selecting the backup policy. Formally, it says for minimum reliability values the pre-emptive methods must use and the protective mechanisms are used for maximum values of reliability.

To satisfy the reliable operations with fault tolerant and robust system, backups are required. These backups are provided on the basis of their backup condition which gives the ratio of backup needed. This ratio is measured in terms of the replica policies. Here the replica is the copy of data which is continuously exchanged between the different

devices at distant locations makes the heterogeneous supportive technology. This replica gets shifted from one location to the other regularly to assure the complete safety of the backup copy of the data. They will communicate with each other using message passing intercommunication (MPI) [2].

Service Providers applies various data recovery techniques which use fault tolerance as a basic formula. These mechanisms require dynamic fault-tolerance and error-recovery options that will agree for serving retrieval. Fault tolerance characteristics should always be incorporated with hardware; platform and networks, as a result the performance and behavior of the system may vary accordingly. These factors additionally restrict scalability and lead to weak portability across platforms and, high implementation and operation costs.

A customer coordinates with the committed administration supplier to accomplish fault tolerance conduct for its applications. It makes the fault tolerant result focused around the customer end prerequisites such that a legitimate harmony between the following factors is attained [3] as shown in figure 1.

(i) *Fault model:* measures the granularity at which the fault tolerance result must handle lapses and failures in the framework. This factor is described by the instruments connected to accomplish fault tolerance, power of failure recognition conventions, and quality of fail over granularity.

(ii) *Asset utilization:* measures the sum and expense of assets that are obliged to understand a faulty model. This factor is typically natural with the granularity of the failure location and recuperation systems as far as CPU, memory, data transfer capacity, I/O, etc.

(iii) *Performance:* manages the effect of the fault tolerance method on the end-to-end nature of administration (QoS) both throughout failure and failure-free periods. This effect is often described utilizing fault identification inert, copy dispatch inactivity and failure recuperation dormancy, and other application-subordinate measurements, for example, transfer speed, idleness, and loss rate.

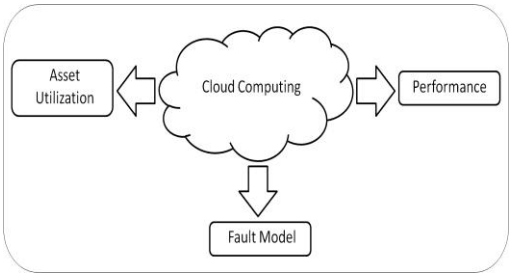

FIGURE 1: KEY REQUIREMENTS IN CLOUD FOR THE CONSUMERS.

II. Background

Cloud computing is at the marketplace because of its huge medium of resources as far as server computation capability, massive storage, infrastructure sharing policies, etc. In this standard, combination of different technologies and components are made to achieve flawless exchanges of information with reduced managerial burdens. Hence, consumers had very little to add understanding of this framework for use and hence give the effective medium. To achieve its objectives cloud computing must give a safe and secure storage services for its clients. This can be given by utilizing fault tolerance mechanism by which more than one copy of information as far as replica is put away in different geographic locations around the globe at different servers. Before understanding the replica let us investigate the sorts of faults accessible to acquire. These are [4] as shown in figure 3:

- ***Proactive fault tolerance:*** The Proactive fault tolerance policy is to maintain a strategic distance from recovery from fault, mistakes and failure by predicting them and proactively replace the suspected component means detects the issue before it actually come.
- ***Reactive fault tolerance*:** Reactive fault tolerance policies reduce the effort of failures when the failure effectively occurs. This technique gives vigor to a framework.
- ***Versatile:*** All the procedure done automatically according to the circumstances.

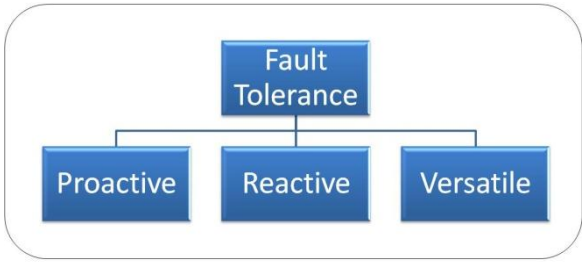

FIGURE 3: TYPES OF FAULT TOLERANCE APPROACHES AVAILABLE.

The above faults can affect nature's turf in different circumstances everything it needs to make the framework which overcomes from any circumstance. For defending any of the above faults category different mechanisms are being proposed in

the course of the last few years. Among them replica based schemes are giving their solid presence. Presently for planning and enhanced fault tolerance mechanism this scheme needs to be clearly examined. So the schemes are given here as:

(i) Semi-active replication:

In this scheme the data can be given to any of the current replica and if a few modifications are made just in essential replica than it ought to be reflected in all at the same time. In this both the essential and secondary replicas produces the yields, however just essential replica is accessible to the end client. If the essential replica fails to load, then quickly the secondary replica burdens to the memory.

(ii) Semi-passive replication:

In this scheme the customary check focuses are setting aside a few minutes based upgrades and modifications. These check focuses having essential replica and creates the buffer between the each check focuses. This buffer information with its state is normally transferred between a few backups. It doesn't execute the instruction yet spares the most recent state of essential replica. If the essential replica fails, then, the secondary replica stacks into the framework.

(iii) Detached replication:

In this scheme, the state information is consistently put away on the backups on an offline based mode. In case of failure this inactive backup copy of the replica is stacked to recently begin VM instance. Here the backup replica is configured for a specific application or can store the different instances of VM. Both the procedure works in offline mode.

The third function is an interface for location estimation which is must for clients working or utilizing such location information or upgrades. This unit passes the measured information to clients in application specific formats. This information may be gone to a client or some other hub for further detection of positions and its redesigns. Hence, the most feasible approach to execute cooperative localization is by making each hub impart its own particular position gauge. Extra to the position gauge, it is critical for different hubs to have a measure of confidence of their position gauge since they may utilize it within their own particular position estimation process.

III. LITERATURE SURVEY

Cloud computing is the balanced combination of various components and existing technologies which resulted as several services to the consumers. Application users of such services get increased day by day accordingly. Mainly the user is interested in backing up important data and accessing their data from different types of devices such as laptop, PDA, PC's, Mobiles, Tablets etc. Thus, effective cloud models are the need to full fill the market demands and especially when security of data is concerned

For expanding the reliability of cloud services and applications some security and fault tolerance system are obliged which make the framework more strong. Amid the last few years different creators had exhibited their work for attaining their point towards fault tolerance and backup services helps. The creator of the paper [5] introduced a methodology of information escalated I/O for fault tolerance in nature's turf. The result is an architectural representation which offers fine grained information access control policies, substantial document offering apportion, high throughputs and concurrency of operations. The applicability of the result is checked in Open Nebula the earth. Expanding the fault tolerance instrument approaches, the creator of the paper [6] does the enhancements for conveyed results. The paper utilizes different burden adjusting techniques for cloud movement, expansion which diminishes the assets burden till the faulty gadget or segment is supplanted. The paper likewise gives a study on different matrix and dispersed environment on the fundamental of burden, quality and security.

Presently considering the different applicability zones where the fault can happen makes the result advancement all the more simple and compelling. In a manner to accomplish this virtualization fault tolerance component is given in the paper [7]. The paper viably investigates the machine portability by which the fault can abuses the cloud adaptability for operations. The paper is centering its intension towards creating the result which is equipped for self overcoming the fault conditions. It might be made possible by utilizing autonomic computing. It requires powerful replica and backup administration for fault localisation and evacuation. Some more replica duplicate and stacking plans are displayed in the work given in paper [8]. It is an auto oversaw key-quality store pool which rapidly utilized for distributing or appointing the assets to the cloud or clients information. It additionally underpins the movement in a versatile way. An arrangement is additionally produced by the methodology as

indicated by which no backup or recovery might be made in harmony conditions.

A percentage of the papers had concentrated on security and security all the while. In approach to accomplish the objectives, this paper [9] presents a Cloudfit model for intrusion tolerant framework. The result is equipped for taking a shot at nature. The methodology takes a shot at BFT calculation by which more security policies could be connected. The calculation is connected infusion of a recovery based result which makes the framework fault tolerant and secure against intrusions. A portion of the creators had just worked with components of cloud performance, for example, expense, power, asset usage, offering, response time and so forth for identifying the fault conditions. In the wake of recognizing the fault and its writers the tolerance or overcoming system as replication and backup is taken. The paper [10] shows and novel asset portion and employment booking methodology for powerfully treatment of burdens and asset imparting. The recommended result in the paper upholds the heterogeneity focused around metric shares which enhances its performance. At the end some confirmation of the viability of the methodology is likewise given in the paper. The paper [11] investigates the impact of failures on applications and clients' information before applying any fault tolerant systems. The point is towards expanding the trust over the framework with high information conveyance rates and failure tolerant frameworks in any rising circumstances.

Presently the framework conduct is constantly changing alongside the classification of faults and thus the plan of tolerance is connected in the wake of comprehending the nature of the issue. Hence, the paper [12] presents an examination of the faults at distinctive circumstances by which their nature expectation might be made which helps in selecting the most suitable replica policies for backups. Mostly the paper had given with an investigation on some cloud segments, for example, server parts , systems and force circulations. It likewise measures the effect of fault on every individual segment and then outlines a component to determine the current issues and gives the complete reliability over the framework. Proceeding with the above work some more performance based fault assessment plans are given to the paper [13]. The paper creates wellbeing discriminating frameworks and gives high reliability utilizing virtual machines. The recommended plan is focused around a characterized rating framework for refashioning and adjusting the fault tolerance. The paper gives a continuous applications particular work of recovery and backups frameworks. Essentially here the framework gives both further and rearward recovery. The principle center here is a versatile performance of the transforming hubs and end or expansion of the hubs on the premise of the reliability.

Subsequently, from the above literature, it is unmistakably recognized that the current fault tolerance technique in cloud computing considers different parameter. The parameters are similar to their kind of fault tolerance (proactive, responsive and versatile), performance, response-time, scalability, throughput, reliability, availability, usability, security and related over-head.

IV. EXISTING ISSUES

In cloud computing predictable perspective of resources is not checked which fails to offer the real condition & thus if there should arise an occurrence of faults substantial data losses or data availability diminished happens.

1) Centralized asset chief is not recognized which imports the distributed burden data for exact investigation underutilized and over-used segments.

2) Decision making identified with fault tolerance or replication plan is not legitimately limit lined and henceforth causes inaccurate choice of unmatched method regarding happened fault.

3) Fault tolerant methods in not matched up with customers prerequisite.

4) Common plan for both proactive and reactive fault is not existing.

5) Generalized fault methods is outlined which causes uneven conduct at the time of new or variable faults.

6) Fault model not takes real system condition before applying the replication plans.

Hence this work expects to enhance availability, scalability and reliability by taking the powerful, timely decisions of creating, disseminating and stacking replicas is distinctive circumstances. It likewise concentrates on ideal asset utilization and query processing for creating a novel enhanced fault tolerance system.

V. PROPOSED SOLUTION

Above studies shows cloud computing is majorly concern with all time service availability without any down time. The primary concern for the consumer is all about availability of his data hosted to the cloud and added services like back up storage and replica. Cloud service providers need to adopt a strong, fault tolerant and efficient scheme so to ensure business continuity fault Tolerance scheme is the only solution to the problem.

Here we are suggesting an adaptive mechanism for replica distribution for effective fault tolerance in cloud computing, which can effectively used to achieve higher level data availability. The approach overcomes the issues connected with settled component however in this approach the fault tolerance is of versatile nature which makes more elasticity and varieties.

The approach gives dynamic nature to distribution and retrieval to ensures the client's data backup in any circumstance. Creating an answer obliges complete understanding of the issues and for cloud computing it is ceaseless data availability for end client. In different circumstances the cloud data neglects to load on end clients machines, and for this situation the proposed replica distribution instrument recognizes the machine to take the backup or do the retrieval. four measurements which are performance, throughput, response time and overhead.

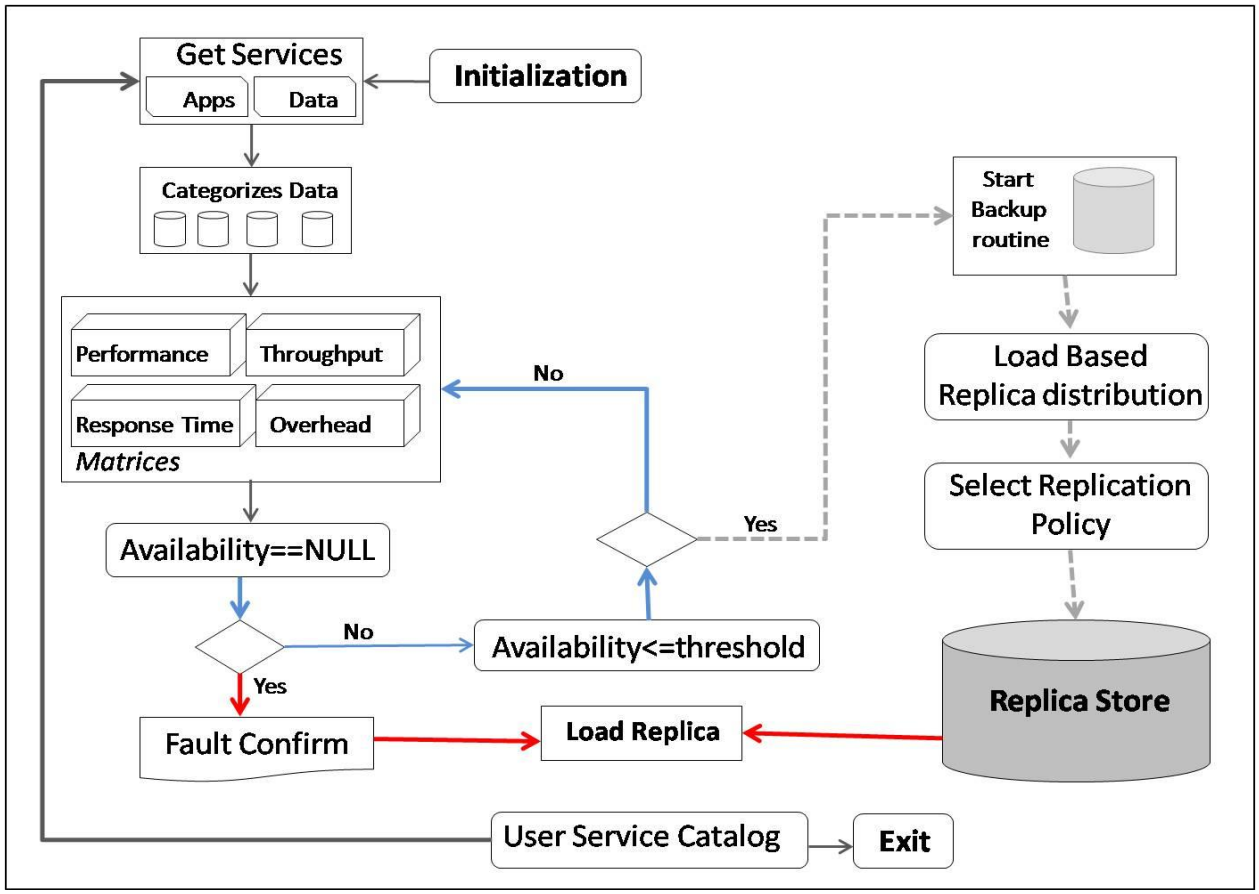

FIGURE 3: PROPOSED ARCHITECTURE

The proposed result works utilizing four significant operations:

(i) Data Fetching: This part points towards getting the data from different cloud resources and clients. The data got to must contains the system data, clients working, data sorts, data sizes, gadgets supportability, power choices, offering and so on. This data may give a deeper research the framework. In the wake of bringing the data, some change if gave which changes over the typical data into measurements structures from which some choice could be taken. The data is passed predominantly into

(ii) Conditional Check: This module functions as a definitive stage for checking the above measurements based data as fault condition identification. This module peruses the data and analyzes its values from the availability conditions. Here the availability implies data access is constant to the client or not. It gives a double check: first is for availability is zero, here the fault is happened, and second is when availability is short of what certain condition termed as edge.

(iii) Fault Solution: The above stage identified the fault event and passes the qualities to this stage like the machine where the fault is happen, which application fizzles, client points of interest, supplier's subtle elements and so forth. In the wake of getting all the essential points of interest the modules stack the past taken backup replica from the replica store.

(iv) Replica Distribution: This stage begins working after the stage two of restrictive checks. In the wake of getting the subtle elements of availability utilizing limit values, some solid replica distribution policies is progressively chosen for serving the backup needs. This adapts are put away too

(v) The replica store with some essential subtle elements of the customer and the machine whose backup is this.

Depiction: Initially, when the framework is in operation then it ought to create some data which is utilized as a fault triggers. Wherever any fault in the framework happens, it influences the typical working of the data and elements are measured to be changed. These components are constantly dissected for distinguishing the states of loss of availabilities of data access. Because of any case if the data is loosed, then the framework accepted fault is happened and works towards stacking the beforehand put away backup replica from the replica store. The performance, calculates after examination produces the estimation of availability which is contrasted with be zero or underneath a specific edge. On the off chance that the condition is not fulfilled, then the ordinary working ceaselessly yet in the event that the conditions are fulfilled then replica stacking or backup is begun. The replica is distributed in various areas utilizing a distinctive replica administration plan like dynamic, semi detached or uninvolved. The determination of replica plan is powerfully chosen in the wake of activating conditions.

So by taking the above development displaying a convincing fault tolerance arrangement could be completed. It promises zero data setbacks & most compelling accessibility of client data. The above proposed arrangement is fit for giving both sort of lack tolerance: Reactive & Proactive. The proposed skeleton is used to bring the decisions related to imperfection occasion suitably and on time. From the above depicted modules of proposed schema it could be clearly seen that the discovery & clearing of insufficiency primarily depends on the parts of nature's area. Decisions related to the replication plan must be associated in the wake of consigning & measuring bona fide conditions. Deficiency tolerant arrangement must be joined in the wake of measuring these progressing qualities. Moreover the kind of replication arrangement used as insufficiency tolerance segment will similarly creates their close-by data whose further reinforcement is taken so in not all that removed future if the same parts are repeated with practically identical setup then the system overhead of estimation is decreased.

Applications: In this work, guideline centre is on creating a versatile fault tolerance plan utilizing element replica appropriation. Henceforth this work recognizes the consistent trouble conforming techniques in distributed computing and further investigates procedures having defect tolerance procurement in duplicate allotment plan. In not all that inaccessible future it in like manner joins a couple of strategies completed to grid processing as both are slightly dispersed figuring. By looking at the techniques on distinctive metric and attempted to discover the degree for enhancing fault tolerance strategy in burden adjusting plans. In not so distant future exploration could be directed on the advancement of burden adjusting calculation of cloud, taking in record fault administration furthermore minimizing movement time of employment if there should be an occurrence of a failure of hub happens and further ensuring ideal performance of the framework. More load changing, figuring could be made which consider proactive technique for defect tolerance in distributed computing for enhancing the adequacy and giving nature of organization quality with the construct of enthusiasm of advantages of cloud for imperative applications. There are few of the applications where issue tolerance could be satisfactorily utilized is as takes after:

- Foundation Management: (Amazon Web Services, Google App Engine)
- Workload Distribution & Access Control: (Role Base Access, Implicit Authentication, VeriSign)
- Administration Agreement Monitoring: (Nimbus, Open Nebula, Social Networking)
- Continuous Systems: (Satellite Image Processing, GMaps)

Some different applications are: IP Monitoring, Storage Solutions, User Management, User Role Based Access Control and Network Configuration with development.

IV. PERFORMANCE FACTORS

RMSE (Root Mean Square Error): This parameter will serve to detect the performance of location estimation in terms of accuracy near by the actual position and identified position. If the difference is less means the approach will serve its aim.

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

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.

Computational Overhead: To identify the location updates frequently the number of steps in processing will increases the burden of computation on each node which reduces the battery life. This will be again a performance parameter.

Time of Detection: This is the time taken to detect the position changes in the nodes locations. If the time of information is near to real time than the approach will proves its effectiveness.

Localization Error: It is the cumulative values which depend upon the above identified parameters. Localization error must be reduced with number of phases of approach and increased nodes and sensor in the network.

VII. EXPECTED BENEFITS

The proposed work will provide the effective decision making regarding the replica distribution as a fault tolerance policy which dynamically takes the updates form current conditions. At the initial level of our work following benefits is identified which definitely proves their accuracy & effectiveness in near future of approach implementation.

(i) Meta data schemes can be easily handled via application level feedbacks.
(ii) Low overheads & real time processing provides pre-emptive approach for fault detection & avoidance.
(iii) All the three categories of faults can be analyzed & hence overall system availability is guaranteed.
(iv) System & application level monitoring can be performed which causes real time analysis & operations.
(v) Data migration is fully performed with minimum probability of data losses.
(vi) Overhead related to system performance & cost is reduced.
(vii) Dynamic changes are incorporated in the replica distribution scheme selection for accurate decision which increases system throughput.

VIII. CONCLUSION

In recent days the technology is changing very fast with user's demand and device supportability. Among them cloud computing is showing its strong presence by its service delivery models and robust and safe environment. But there are some situations where the traditional cloud models fail to provide dynamic decisions in case of failures. Thus, the existing fault solutions are partially useful .There is a tremendous need of fault tolerance policy which will meet the demands and produce optimized throughput with all the advantages of cloud computing.

REFERENCES

[1] Ravi Jhawar, Vincenzo Piuri and Marco Santambrogio, "Fault Tolerance Management in Cloud Computing: A System-Level Perspective", in IEEE Transaction, ISSN: 1932-8184,doi: 10.1109/JSYST.2012.2221934,2012.
[2] Dinesh Rajan, Anthony Canino, Jesus A Izaguirre, and Douglas Thain, "Converting A High Performance Application to an Elastic Cloud Application", in Department of Computer Science and Engineering University of Notre Dame , Indiana
[3] Sheheryar Malik and Fabrice Huet, "Adaptive Fault Tolerance in Real Time Cloud Computing", IEEE World Congress, ISSN: 978-0-7695-4461-8/11, DOI 10.1109/SERVICES.2011.108, 2011.
[4] Wenbing Zhao, P. M. Melliar-Smith and L. E. Moser, "Fault Tolerance Middleware for Cloud Computing", in IEEE 3rd International Conference on Cloud Computing, ISSN: 978-0-7695-4130-3/10, DOI 10.1109/CLOUD.2010.26, 2010.
[5] Houssem-Eddine Chihoub, Gabriel Antoniu and Maria S. Perez-Hernandez, "Towards a scalable, fault-tolerant, self-adaptive storage for the clouds", in INRIA, Rennes - Bretagne Atlantique, France
[6] Akanksha Chandola Anthwal and Nipur, " Survey of Fault Tolerance Policy for Load Balancing Scheme in Distributed Computing", in International Journal of Computer Applications , ISSN:0975 – 8887, Volume 74– No.15, July 2013
[7] Alain Tchana, Laurent Broto and Daniel Hagimont, "Fault Tolerant Approaches in Cloud Computing Infrastructures", in ICAS 2012 :The Eighth International Conference on Autonomic and Autonomous Systems, IARIA Journal, ISBN: 978-1-61208-187-8,2012.
[8] Nicolas Bonvin, Thanasis G. Papaioannou and Karl Aberer, "A Self-Organized, Fault-Tolerant and

Scalable Replication Scheme for Cloud Storage", in ACM Journal, doi: 978-1-4503-0036-0/10/06, 2010.

[9] Hans P. Reiser, "Byzantine Fault Tolerance for the Cloud", in University of Lisbon Faculty of Science, Portugal, at http://cloudfit.di.fc.ul.pt

[10] Gunho Lee, Byung-Gon Chun and Randy H. Katz, "Heterogeneity-Aware Resource Allocation and Scheduling in the Cloud", in University of California, Berkeley.

[11] Ravi Jhawar and Vincenzo Piuri , " Fault Tolerance and Resilience in Cloud Computing Environments", in Computer and Information Security Handbook,2nd Edition Morgan Kauffman, ISBN:978-0-1239-4397-2,2013.

[12] Ravi Jhawar and Vincenzo Piuri, "Fault Tolerance Management in IaaS Clouds", in IEEE Transaction on Cloud Computing, 2012.

[13] Shivam Nagpal and Parveen Kumar , "A Study on Adaptive Fault Tolerance in Real Time Cloud Computing", in International Journal of Advanced Research in Computer Science and Software Engineering (IJarcsse), ISSN: 2277 128X, Volume 3, Issue 3, March 2013.