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Implementation and Analysis of Replicated Agent Based Load Balancing In Cloud Computing

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Abstract: Cloud computing is growing as a new paradigm of large-scale distributed computing. It is an agenda for permitting appropriate, on-demand network access to a shared pool of computing resources. Load balancing is the foremost challenges in cloud computing which is vital to distribute the dynamic amount of workload through multiple nodes to confirm that no single node is overwhelmed. Cloud computing is an innovative technology which practices virtual machine instead of physical machine to manage, store and network the different mechanisms. In different virtual machines load balancers are used for assigning load in such a way that none of the nodes gets loaded heavily or lightly. The research area in load balancing is becoming more interested in the cloud computing. And through better load balancing in cloud, the performance is increased and user gets improved services. Here in this paper we have discussed different load balancing techniques along with the proposed technique used to solve the issue of data migration and data security using P-AES.

Keywords: Cloud Computing, Virtual Machine Migration, Grid Computing, Load Balancing

I. INTRODUCTION

Cloud Computing is a new eon which targets to have pooled data over a one platform. As the technology is booming rapidly, so does the client's requirements. The new paradigm of cloud computing is engaging vendors which upsurges its popularity. [1],[13]As NIST's definition says "Cloud Computing is a model for allowing suitable, on-demand network contact to a shared group of configurable computing resources (e.g. network, server, storage and applications and services) which can be rapidly provisioned and unconstrained with minimal administration efforts or service provider interaction. Cloud delivers resources over Internet using virtualization technology, multi-tenancy, web services, etc. Virtualization provides concept of self-regulating hardware access to each virtual machine. Application interconnects over the Internet by means of web services.

The whole Internet can be observed as a cloud Fig. 1. By using cloud computing capital and operational costs can be amended even.

Load balancing in cloud computing systems is indeed challenge these days. In cloud computing load balancing is one of the fundamental issues. [3]This is a mechanism that distributes the dynamic confined workload uniformly across all the nodes in the entire cloud to evade a situation where some nodes are severely loaded while others are idle or performing minute work. Thus it aids to attain a high user satisfaction and resource utilization ratio, hence refining the overall performance and resource utility of the processing system.

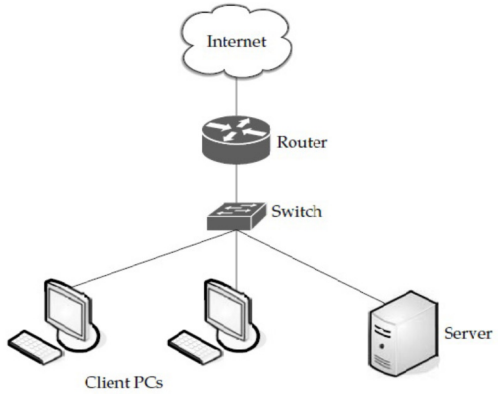

Figure 1: A cloud is used in network diagrams to depict the Internet

The primary objective of this research work is to improve the checkpoint efficiency and prevent checkpoint from becoming the bottleneck of cloud data centers. Agents are sophisticated computer programs that act autonomously on behalf of their users across the open and distributed backgrounds, to solve an increasing number of difficult problems. However, increasing no. of applications require multiple agents that can work together. A multi-agent system (MAS) is a loosely coupled network of software agents that interact to solve problems that are beyond the individual capacities or knowledge of each problem solver. The multi-agent system (MAS) allocates computational resources and capabilities across a network of interconnected agents. The MAS permits

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for the interconnection and interoperation of multiple existing legacy systems. To reduce the over-loading of agents, we need to perform load balancing by performing data migration with replicated agents. Virtualization is a method to generate a virtual or replicated form of a device or resource that can be a server, storing device, any network or even an operating system to unload a physical machine that is currently heavily loaded. Virtual machine migration is one key challenge for the load balancing in clouds. In current paper we are working for virtual machine migration

II. TAXONOMY

A. *Cloud Computing Services*

According to NIST, Cloud Computing provides 3 service models i.e. Software as a Service, Platform as a Service and Infrastructure as a Service. Cloud Computing has become one of the most talked about technologies in recent times and has got lots of attention from media as well as analysts because of the opportunities it is offering. These 3 fundamental classifications are often referred to as "SPI model".

- *Cloud Software as Service:* This has the capability in which the cloud computing applications that are running on the cloud can be used by consumer, which is ability.

- *Cloud Platform as Service:* This has the capability which, the consumer can deploy cloud infrastructure, can use applications by using programming language, using tools provided by the provider or consumer-created or acquired applications-created.

- *Cloud Infrastructure as Service*: This is a capability which is provisioned to the consumer by which it can access processing, storage, networks where the consumer is able deploy and run the arbitrary software.

Table 1: Services offered by Cloud Computing

Services offered	Definition	Layer	E.g.
1. SaaS (Software as a Service)	SaaS provides the vendor with the software. Vendor pays for the time of using the software and can use it anywhere. There is no need to buy the software. It is referred to as "on-demand" software.	Application Layer	GoogleApp, salesForce.com
2. PaaS (Platform as a Service)	It provides a platform where resources are available and consumers can themselves create the required applications for e.g. web application data and database data. Providers provide network, servers, and storage services.	Platform Layer	Google AppEngine, Microsoft Azure
3. IaaS (Infrastructure as a Service or Hardware as a Service)	This model provides users with the hardware on rent for e.g. server space, network equipment, memory, storage space. In short consumer buys virtual space and works on it.	Hardware Layer	Amazon EC2, Simple Storage Service(S3)

B. *Advantages And Disadvantages of Cloud Computing*

Cloud computing offers lots of advantages[1]:

a) *Cost* - In cloud computing the users need not to owe the resources; they just have to pay as per the usage in terms of time, storage and services. It reduces the cost of maintaining the infrastructure.

b) *Performance*- Clouds on the single computer, resulting in high processing power because it enacts as a large network of powerful computers which improves the performance.

c) *Freedom from up gradation and maintenance*- cloud service provider maintains and upgrades the cloud infrastructure.

d) *Scalability*- The user is can request to increase the resources if the area of application grows or new functionality is added. On the other hand if requirement shrinks the user can request to reduce the resources as well.

e) *Speedy Implementation*- Time of Implementation of cloud for an application may be in days or sometimes in hours. You just need a valid credit card and need to fulfill some online registration formalities.

f) *Green*- The cloud computing is a green technology since it enable resource sharing among users thus not requiring large data centers that consumes a lot of power.

g) *Mobility*- We don't need to carry our personal computer, because we can access our documents anytime anywhere.

h) *Maximized Storage Capacity*- In cloud computing we have extreme resources for storing data because our storage consists of many bases in the Cloud. Another thing about storing data in the Cloud is that, because of our data in the Cloud can automatically duplicated, they will be more safety.

Along with list of advantages, several constraints are also found in the usage of cloud computing are as follows:

a. When the applications, processes and data are tightly coupled or interdependent.
b. When to share the data, process and behavior within an application there is not well defined points.
c. When a very high level of security is required in the application.
d. When you want total control over your processes and data but cannot outsource your application or its major components.
e. When the core architecture of the organization is not running well, and then firstly make it strong so that it can be mapped easily to cloud architecture.
f. When one needs built-in APIs, subsequently the cloud does not provide native APIs.
g. When someone at present using a legacy system, meanwhile older systems possess number of complications to move to cloud architecture.

C. Related Technology

Cloud computing typically has characteristics of all these technologies [20] :

a. Grid computing
b. Virtualization
c. Utility Computing
d. Autonomic Computing

A quick overview of these technologies is given here.

Grid Computing- Grid Computing includes a network of computers that are consumed together to gain huge supercomputing type computing resources. By using this network of computers large and complex computing operations can be achieved. In grid computing these kinds of networks of computers may be present in different positions. A well-known Grid Computing project is Folding@Home. The project comprises of utilizing idle computing powers of thousands of computers to implement a complex scientific problem. The main objective of the project is "to realize protein folding, missfolding, and linked diseases".

Virtualization- In broad-spectrum sense, a traditional multiprogramming operating system, such as Linux is also a type of virtualization. Linux allows every single user method to access system resources without any interfere to other methods. The concept provided to each process is the set of operating system, system calls and hardware instructions set manageable to user level practices. Linux User mode suggests a more complete virtual abstraction where every single user is not even responsive of other user's processes. At a developed level of abstraction are virtual machines which are established on high level language, for example the Java Virtual Machine (JVM). It works as an operating system procedure, but delivers a self-regulating system abstraction of the mechanism to an application written in Java language. Generalization at the OS system call layer or higher are called process virtual machines.

Utility Computing- The utility Computing defines a "pay-per-use" model for exhausting computing services. In this computing model, billing model of computing resources is alike to how services like electricity are usually billed. When we attain electricity from a vendor, the original cost required is negligible. Established upon the procedure of electricity, the electricity companies bills the client (typically once-a-month). Here utility computing billing is completed using a related protocol. Numerous billing models are being explored.

III. NEED OF LOAD BALANCING IN CLOUD COMPUTING

In cloud computing load balancing is a mechanism that allocates the excess dynamic local workload uniformly across all the nodes. [2]This is used to attain a high user satisfaction and resource utilization ratio and making sure that no single node is overwhelmed, henceforth improving the overall performance of the processing system. Proper load balancing can support in utilizing the available resources optimally, thus minimizing the resource consumption. It also aids in carry out fail-over, enabling scalability, evading bottlenecks, over-provisioning, reducing response time etc.

The goals of load balancing are to:

- Improve the performance.
- Maintain system stability.
- Build fault tolerance system
- Accommodate future modification.

IV. EXISTING TECHNIQUES IN LOAD-BALANCING

Many studies were conducted in load balancing in the cloud computing, some are destined to specific domain where a specific flow is adapted to Cloud computing. [4],[8],[18]We are discussing the following techniques which are using to balance load in the cloud computing:-

• **Role Based Access Control (RBAC):** RBAC is an approach used to shrink the load of the cloud. In this, a role is allocated to every single user so that limited number of applications of the cloud can gain access by their respective number of users. So by this manner, the resources are restricted to the users.

• **Resource Allocation Scheduling Algorithm (RASA):** In this algorithm, virtual nodes are formed first. Then the estimated response time of every single virtual node is found. According to the least loaded node criteria, efficient virtual node is found and that node ID is returned to the client. In this, Min-Min and Max-Min approaches are followed. If odd number of resources is available and then the Min-Min strategy is applied either Max-Min strategy is applied.

• **Ant Colony Optimization Technique:** In this technique, the resource utilization and the design of a pheromone table which was updated by ants as per node selection formula. Ants move in frontward direction to examine the overloaded or under loaded node. As the overloaded node is navigated, then ants move back to seal the recently encountered under loaded node, so a single table is updated by every single time.

• **Equally Spread Current Execution:** Equally spread current execution lies under the dynamic load balancing algorithm, which handles the procedure with priority. It regulates the priority by examining the size of the process. In this algorithm first check the size of the process by distributing the load randomly and then transferring the load to a Virtual Machine, which is lightly loaded. The load balancer circulates the load on to different nodes, and therefore, it is known as spread spectrum technique.

V. PROPOSED WORK.

We have proposed that the problem of virtual machines migration has overcame by the use of replicated agent system. When we generate an agent system, it will create extra over-load upon the group of servers. To reduce the over-loading of agents, we need to perform load balancing by performing data migration with replicated agents. To balance the load between the multiple requests we need to place Replicated Agent that will handle the data when main data server gets overloaded. This process not only enhances the efficiency in normal routine but also enhancing the security by using Proposed AES (P-AES).

Cryptography enacts an vital role in the safety of data transmission. On January 2, 1997, the National Institute of Standards and Technology (NIST) called proposals for new algorithms for the Advanced Encryption Standard (AES). When choosing the AES algorithm, equally efficient software and hardware implementations were taken into concern. Many different applications of the AES algorithm may necessitate different speed/area trade-offs. Some applications for instance smart cards and cellular phones need small area. Further many other applications for example WWW servers and ATMs are speed critical. Various other applications for example digital video recorders, have need of an optimization of speed/area ratio. The AES algorithm is a symmetric-key block cipher in which both the user and client uses single key to encrypt and decrypt the data.

In this paper we are using P-AES algorithm which is the hybrid of Modified-AES(M-AES) and Transposition-AES (T-AES).

$$\text{P-AES} = \text{M-AES} + \text{T-AES}$$

Where M-AES= Modified-Advanced Encryption Standard
T-AES= Transposition-Advanced Encryption Standard

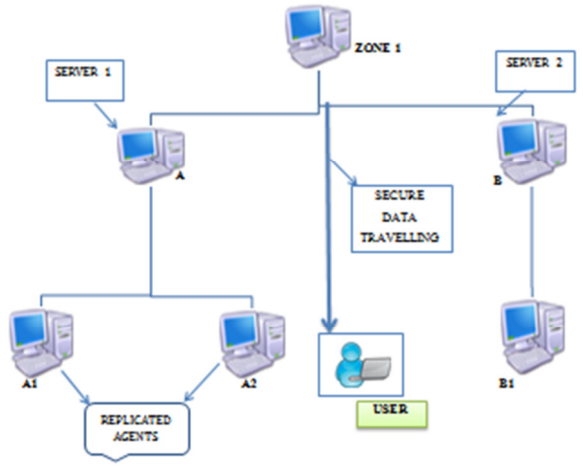


Figure 2: In the above figure we have shown our proposed technique using replicated agents and the secure data travelling means that data is transmitting the user through secure technique using encryption of Proposed- Advanced Encryption Standard (P-AES).

A. *How The Flow Diagram Works ?*

The below flow diagram works as following:-

STEP 1- Start request

STEP 2- Send data over the cloud

STEP 3- Check whether the server is loaded or not.

STEP 4- If the server is loaded, then push back to agent. Further if the load is more we have divided the agents into sections 1,2,3,4. There we will check that if first agent is loaded then we send the load to the second server and so on.

STEP 5- While checking the load over agent, we also check that is the server free from load if yes then send to step 1.

STEP 6- If the server is not loaded, then for data security we apply P-AES Algorithm for strong data integrity.

STEP 7- Send the secured data to the client.

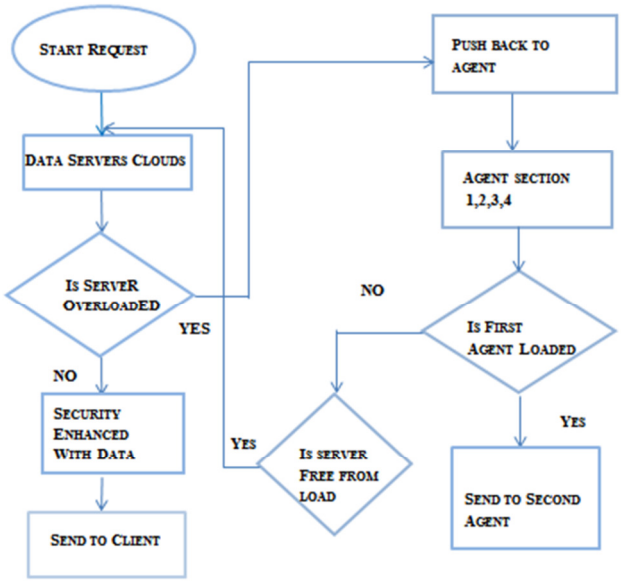


Figure 3: Flow Diagram of proposed technique.

B. *Performance Metrics Used In Implementation*

Three important performance metrics are evaluated:

1. Packet delivery fraction: The ratio of the data packets delivered to the destinations to those generated by the CBR sources.
2. Average end-to-end delay of data packets: This includes all possible delays caused by buffering during route

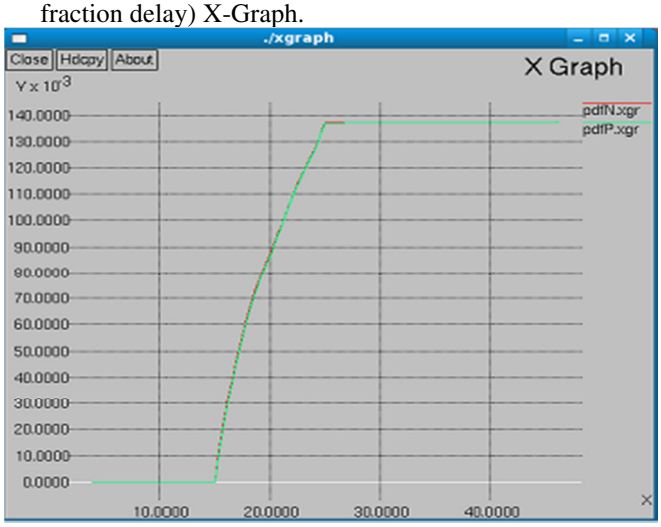
discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times

3. Throughput: - Throughput or network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

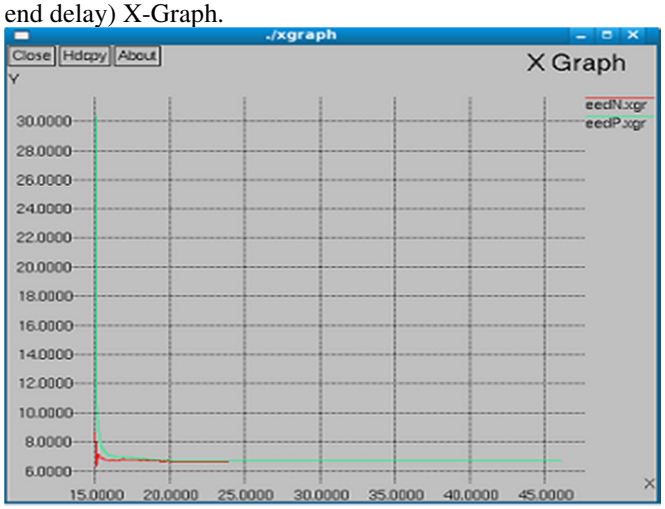
C. Implementation And Analysis Results

In this section we evaluate the effectiveness of proposed technique that is by using various parameters we are enhancing the load balancing problem by using replicated agents and also enhancing its security. We have generated the graphs of our proposed method by using three parameters first is packet fraction delay, second is end-to-end delay and the third is throughput.

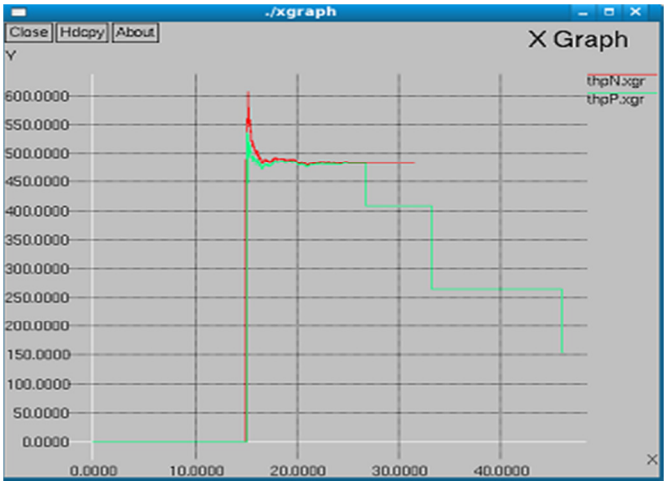
1. Post analysis of both the trace files to obtain pdf (packet fraction delay) X-Graph.



2. Post analysis of both the trace files to obtain eed(end-to-end delay) X-Graph.



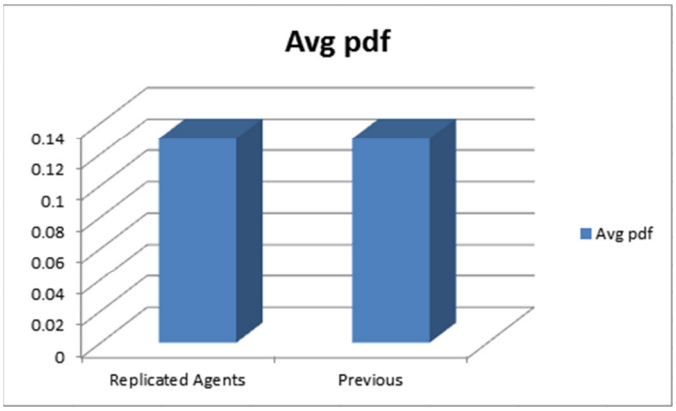
3. Post analysis of both the trace files to obtain throughput X-Graph.



The Average result of these above parameter's xgraph i.e. pdf, end to end delay and throughput is compiled below:-

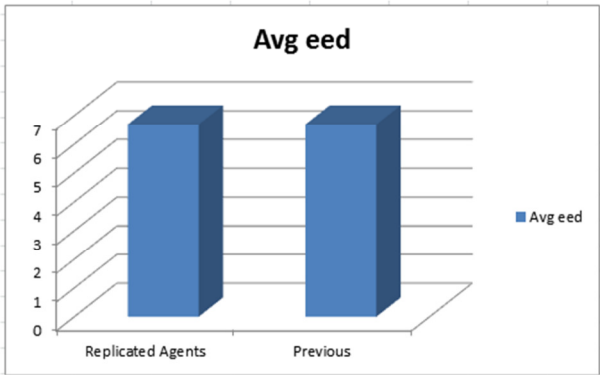
1. Average packet delivery fraction computed from the values of above mentioned table.

Technique	Average packet delivery fraction(pdf)
With replicated agents	0.13
With previous technique	0.13



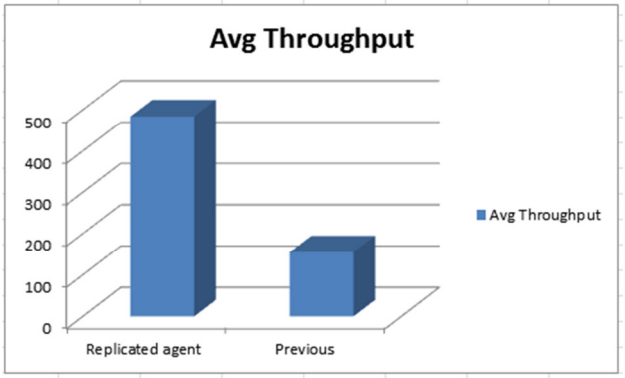
2. Average end-to-end delay computed from the values of above mentioned table.

Technique	Average end-to-end delay(eed)
With replicated agents	6.69
With previous technique	6.69



3. **Average throughput computed from the values of above mentioned table.**

Technique	Average throughput
With replicated agents	484
With previous technique	155



VI. CONCLUSION

In this current paper we have presented the cloud based architecture and enlightens all its perspectives. We have also presented our new technique which is secure by using strong algorithm i.e. P-AES and load is properly balanced in effective manner. From the given graphs and table values is analyzed that our technique has less delay, greater throughput and consistent packet delivery fraction.
In future we will work with hybrid technique to make more betterment in the results.

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