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A Study on Replication and Failover Cluster to Maximize System Uptime

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ABSTRACT

Different types of clients over the globe uses Cloud services because cloud computing involves various features and advantages such as building cost-effectives solutions for business, scale resources up and down according to the current demand and many more. But from the cloud-provider point of view, there are many challenges that need to be faced in order to ensure a hassle free service delivery to the clients. One such problem is to maintain high availability of services. This project aims at presenting a high available (HA) solution for business continuity and disaster recovery through configuration of various other services such as load balancing, elasticity and replication.

KEYWORDS: *Cloud services, cloud-provider, high availability, business continuity, disaster recovery, load balancing, elasticity, replication*

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I. INTRODUCTION

The major concerns of cloud computing involves Reliability and High availability of resources. From the cloud provider point of view, it has been always an essential job to provide the customers with on-demand services ensuring they are reliable, secured and available on time. Without these, the customers or the clients are tend to face revenue losses in the business end hampering their continuity of business plans. Service downtime not only effects user experience in a bad way but also directly translates into money loss. To eliminate these kind of outages, cloud providers have been focusing on finding ways to enhance their infrastructure and management strategies to achieve high available services. For something like this, it's not just enough to have a failover cluster but also we need multiple redundant energy sources and even to have replication between multiple locations in case of disasters. It is mainly seen that only multinational companies could afford such a setup. But with the help of IaaS and PaaS, however, the cost of building such a service have decreased dramatically.

This project aims on building a High Availability (HA) architecture to host websites in a reliable manner. The websites should be scalable, fault tolerant, have a disaster recovery plan and at any point of time the customer should not be facing a problem or a connectivity issue.

II. Literature Review

1. In this paper, the author uses Digital Media Distribution platform to deliver multimedia content. The author here presents a modern solution for server less platform of digital media for distribution of media content on Amzon Web Services (AWS). This platform uses Amazon AWS services for storage, content delivery optimization, lambda execution, media transcoding, authentication and logging.
2. This paper states that an user experience and the costs of providing the same video streaming service can vary when using different cloud CDNs. There are users over the internet who would be using video streaming and those users are then emulated to find the best Content Delivery Network among many such as AWS Cloud Front, Microsft Azure Verizon CDN and Google Cloud CDN over a platform known as PlanetLab. Quality of Experience (QoE) is evalutated.
3. In this paper the author demonstrates an approach on how to expedite the auto-scaling strategy for their use case: public transportation web sites using the AWS application suite. If Social network monitoring and auto scaling frameworks are combined, this approach can be greatly used to reduce OpEx impact of over-provisiong and under-provisioning as well can reduce the business cost later.
4. In this paper, the author has introduced a measurement-driven methodology for evaluating the impact of replication on the QoS of relational DBaaS offerings. The methodology builds upon an analytical model representing the database cluster configurations

combined with an environment model to represent the transient replication stages. This model thus represents how a cloud database can achieve High Availability (HA) when data is automatically replicated on multiples nodes.

5. In this paper, the author proposes a scheme called PDFE where they use Parallel State Machine Replication which allows execution of ordered commands in a flexible manner. There are two kind of threads namely the work thread and ordered threads. The binding between these threads can be dynamic and hence any thread that faces high work load can be executed first. Such flexibility can help achieve load balancing.
6. In this paper, the author proposes a way to minimize the power consumption while transfer of data called SWIN (Sliding Window replica strategy) which is data aware. It minimizes the amount of data transferred and the storage needed also cutting cost to some extent. This can be applied not only to data grids but also cloud computing systems.
7. Over the years, distributed storage clusters are being widely used. But replication in such cluster have been a concern since the internal bandwidth of the cluster is sometimes low. If any replication is misplaced then it might effect the overall performance of the cluster. In order to reduce the internal network traffic and to improve the load balancing, the author has proposed a centralized replication management scheme. It captures replica location and network traffic. It uses 0-1 programming scheme to locate replicas.
8. In this paper, the author discusses the usage of artificial intelligence for high availability of resources. After the training of artificial neural networks , it can choose the best node possible for resource group fall over. The above scheme helps us to choose the best possible failover node in the cluster through ANN.
9. The author says that traditionally used hardware firewalls had many disadvantages due to its limitations in physical deployment. These problems thus can be mitigated through Network Function Virtualizations NVF by implementing various network functions in software. It provides various synchronization strategies that allows sharing of connection states among the cluster to maintain high availability and scalability.
10. In this paper the author proposes an architecture which is helpful for intensive trace analysis. This architecture contains essential techniques that amalgamate SolrCloud, Apache Spark, and SMW. The architecture provides a way to develop cloud monitoring applications with advance algorithms for forecasting data and identifying workload patterns.

III. Methodologies/ Algorithms

Cloud CDN: Amazon Cloud Front is a web service that gives business and web application developers an easy and cost effective way to distribute content with low latency and high data transfer speed. It also helps to protect websites against some common malicious attacks such as Distributed Denial of Service (DDoS) attacks. Cloud Front comes with two types namely Web and RTMP. RTMP is mainly used for streaming media files using Adobe Flash Media whereas Web is used for normal contents example .html, .css, .php and graphic files which used HTTP and HTTPs for distribution. The one that we use in this architecture is Web.

State Machine Replication: It is a method/approach used in distributed computing for building fault tolerant systems. State machine at any point stores a state of the system. It receives a set of commands or inputs and it applies these commands in a sequential order using a transition function to generate an output. An example of State Machine Replication is the Bitcoin ledger. In a fault tolerant state machine replication, instead of maintaining a single server, this system uses multiple server replicas some of which can be faulty. The consolidation of several servers are represented as the same interface as that of a single server to the client. However one main disadvantage of this algorithm is that it doesn't necessarily guarantee the increase of service throughput.

Back Propagation Neural Network: BPNN algorithm is a multi layer network and is one of the widely applied neural network models. It can be used to store mapping relations of input-output models. This algorithm works by computing the gradient of the loss function with respect to each weight. The central idea is to get the smallest error though adjusting the weight of network. That is, using gradient search technology to make the square error values minimum between the actual output of network and expectation.

Markov Decision Process: MDP is a discrete time control process. It provides a mathematical framework for versioning decision making situations where some outcomes are partly random and while other are under the control of a decision maker. This algorithm can be used to determine whether to migrate a service or not in case of failover cluster during any disaster or when needed.

Sliding Window Protocol: The Sliding Window Protocol is a well known method which can be used for reliable and effective transfer of data over various undependable channels that can lose, re-assemble and duplicate messages. There are mainly two components: the sender and the receiver. They are mostly used in case that needs high reliability of data transmission.

IV. Scope

The objectives of the project is as follow:

- To build a scalable environment.
- To have a disaster recovery plan.
- To have an environment which is highly available.
- To enhance the trust and satisfaction of customers.
- To ensure business continuity.
- To have a backup plan available.
- To configure various replications in different regions which will ensure fault tolerance.

The scope of the project is **limited** to the following points:

- In case of failure, if all the regions fails, data would be lost. So it is always better to ensure that one of the both (or both) sites is working properly.
- As the traffic grows, the cost of using Cloud Front can increase very rapidly.

V. Conclusions

As far as the proceedings have been done, it is clear that a proper planned architecture for data replication and failover cluster is a necessary thing to do since it helps us to plan and control the flow of data maintaining a backup system for data safety in case of disaster recovery. This project on

building a High Availability (HA) architecture to host websites in a reliable manner has thus become a perfect solution in order to keep customer's trust. The websites is thus scalable, fault tolerant, have a disaster recovery plan and at any point of time the customer shall not face a problem or a connectivity issue.

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