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A Study on Tools for Cloud Disaster Management

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Abstract

Cloud Computing is a platform that offers resource sharing in terms of justifiable and scalable infrastructure for Cloud applications. Cloud has brought a huge transformation of the entire computing industry. Currently, the advent of cloud platform as a latest model of service provisioning in distributed systems, has motivated researchers to investigate its benefits in executing scientific applications and the Big data. One of the major significant issues in this model is that it is prone to Disaster. Several simulation tools are developed to test system efficiency, cost and complexity of cloud applications. Despite the existence of various tools, disasters continue to prevail in Cloud applications. The aim of this paper is therefore to analyze different simulation tools for various disasters recovery in Cloud computing. This analysis enables one to comprehend the choice of tools for their applications. This knowledge further provides information about parameters that are supported by the tools and hence opens up research avenues towards those parameters which are not yet deemed in the tools.
Keywords: Cloud computing, Disaster recovery, Simulation tools, Scheduling, Deadlock, Availability

Introduction

Information and Communication are the two most important strategic issues for the success of IT industries. For effective usage of the information technology, advanced networking is essential, which supports the ideology of resource sharing in a heterogeneous environment. The advancement in resource sharing lead to the development of grid computing where in more than one resource would co-ordinate to solve a problem. The traditional way of computation was always very complicated and expensive, which required huge amount of hardware and software. It required a team of experts to install, configure, test, run, secure, and update them. As technology advanced the demand for more IT resources increased henceforth leading towards the emergence of the Cloud model. Cloud computing has gained growing popularity in IT industry due to the features like, resource sharing in terms of scalable and virtualized resources which are well suited for massive data computation and storage over the internet, reasonable infrastructure investment, tremendous elasticity, less maintenance cost.

As cloud inherits the properties of distributed computing, few of the leading IT industries have developed various applications in support of heterogeneous applications. Industries providing cloud services have also developed applications like social platform comprising of work from anywhere or any device, share information and knowledge across teams, departments and geographies etc[1]. However, Cloud model does not access the required resources directly; rather it accesses them as Services. As an instance, in lieu of requesting directly for a hard drive to store or request for the need of a specific CPU for the computation purpose and so on, the cloud model requests to some Service which in turn provides these resources. The Service then maps the requests for resources to its physical resources and dynamically allocates them. Cloud thus emerged as an upshot of advancement in technology to store, process and effectively manage massive amount of data in addition to further process various requests as posted by its clients. Cloud computing is a pay go model offering the clients with pay as peruse strategy. The up gradation of the hardware or the software is automatic and also scaling up or down is not tedious. Therefore, IT service industries are going through rapid changes with the increasing espousal of Cloud computing. The Cloud model aims to power the datacenters by tailoring network of virtual services of resources such as hardware, network bandwidth, software etc, so that the clients are able to access and deploy applications from any geographical location. Nevertheless, the advancement in technology, disasters continue to exist[2]. Hence, several tools are developed in order to reduce and effectively manage occurrences of various disasters in cloud.

Materials and Method

[1] THE VARIOUS DEPLOYMENT MODEL OF CLOUD

The deployment models are architected based on the utility of services as explained below:

A. Private Cloud: Data in the private cloud is handled by the private organization. The available data can be accessed only by a particular customer and managed by a single organization[3]. This cloud provides higher level of security. Some of the leading

private clouds include eBay, HP.

B. Public Cloud: With the internet connectivity, the customer can access data via web applications or web services. This cloud is more elastic, more vulnerable and less secured than private clouds. Some of the popular public clouds are Go Grid, Google App Engine, and Microsoft's Azure etc.

C. Hybrid Cloud: Cloud in this environment is a combination of Public and Private Cloud with multiple service providers which allows data to transmit among them without disturbing each other. It is highly scalable and flexible. The most popular service providers of hybrid clouds are HP, Oracle and VMware.

Clients thus can avail the following services from the aforementioned models. Below are the categorizations of services provisioned by the cloud models.

[2] CATEGORIZATION OF CLOUD SERVICES

A. Software-as-a Service (SaaS): It is a multitenant platform, where the users have provision to access applications and resources. This service is also known as Application Service Provider (ASP)[4]. It is widely used by business organizations. Some of the SaaS providers are SalesForce.com, Net suite, IBM, Oracle, etc.

B. Platform-as-a-Service (PaaS): Consumers utilize the PaaS services to develop and deploy new soft ware's libraries and other software applications[5]. The provider majorly emphasizes upon developing applications. The important PaaS providers are Google Apps Engines, Microsoft Azure, etc.

C. Infrastructure-as-a-Service (IaaS): The IaaS provider provision infrastructure like memory, processing power, bandwidth etc to its clients. These services are provisioned through virtualization. IaaS model is more flexible in terms of cost and updating the operating systems than SaaS model. One of the leading IaaS providers includes Amazon Web Services[6].

The main objective for providing aforesaid services through various giant service providers is only to accomplish and retain total customer satisfaction. Despite of various strategies incorporated in IT industries to provide undisturbed and customer satisfied services, disasters continue to prevail with every model and any service[7]. Disaster is an unexpected event that occurs in the system during its operational life time. Disaster in cloud is one of the critical issues that need to be addressed efficiently. Disaster can be anything from crashing of the data servers, networks and other resources which form the backbone of the Cloud System to occurrences of catastrophic accidents.

This research therefore aimed towards a study on various tools that exists for disasters management in cloud environment. Details about the various tools that are used to resolve disasters are provided in Table 2. Few possible rationales for the occurrences of disasters can be stated as below. When many applications pop in to the cloud simultaneously, the cloud is overloaded and it leads to disasters, the causes for disaster include improper scheduling, deadlock, non availability of resource. Disasters further attributes due to catastrophic failures (earthquakes, floods, fire, tsunami, etc), network failure, power outage, limited energy, power failure, limited bandwidth of nodes, link failure, mobility of nodes, dynamic topology and so on. Additionally, occurrence of possible disasters in each cloud deployment models and services is very high. The disaster can however be overcome with efficient scheduling techniques of resources, efficient algorithms for deadlock avoidance, availability of resources etc[8]. Further, there exist several tools to resolve and overcome disasters in cloud.

[3] LITERATURE SURVEY

I. Yoichiro Ueno[9] has proposed a technique for disaster recovery in Distribution and Rake Technology (HS-DRT). This disaster recovery technique is an innovative file backup concept which enables disaster recovery and data backup. Due to data replication, implementation of HS-DRT technology and maintenance of cloud system is expensive.

II. Chi-won Song[10] have focused on effective disaster recovery and data backup. Their work is based on Parity Cloud Service [PCS]. This approach provides privacy and data protection. The recovered data is highly secured and reliable. They state that cost for providing data privacy is low in their approach but the implementation of technology is complex.

III. Vijaykumar Javaraiah[11] focused their research work on disaster recovery and data backup. The author has used Linux box approach. The proposed approach is simple and cost effective. Due to minimal availability of bandwidth their contribution is unable to take the complete backup from the server.

IV. Giuseppe Pirr[12] recommended Efficient Routing Grounded on Taxonomy Technology (ERGOT) for disaster recovery and data backup. ERGOT technique is based on semantic system for Cloud Computing and the approach consumes more time for data recovery and the implementation is tedious.

The above study indicates that regardless of various approaches and techniques, yet effective disaster management is not fully achievable. This research provides succinct information about various tools that can aid in cloud disaster management.

Results

This section provides details of various tools that is available in the cloud market for addressing disasters in cloud environment. Table 1 (annexure) illustrates the existing tools applicable for various Cloud models and Services which are susceptible to disaster and also presents respective disaster recovery tools. Table 2 (annexure) presents the comparison of various tools applicable for disaster recovery in Cloud. It depicts the parameters handled by various tools and the platform in which they are implemented. Table 2 (annexure) infers the probable list of parameters that opens up opportunities for disasters to occur. The table further specifies the tools that can handle few of those parameters. Table thus indicates the lacunae of some tools in addressing all parameters that can lead towards disasters. This study therefore throws light on tools that exhibit a conservative mode of support wherein few parameters are handled while others are not deemed in the tool supporting features. The table also signifies the VM support for various tools.

A. AppSim: is an Internet level application simulator which is used for Software-as-a Service. This tool supports Multitenant applications and can be efficiently used for calculating multitenant non functional requirements. It has two mechanisms that are Load Generator and Virtual Distributors[13].

B. Google App Engine: Google App Engine is a Java and Python based platform that affords web application, resource storage and application hosting, data storage, and high-speed networking by Google's huge infrastructure. It is easy to scale, build and maintain resources. It provides a high level access to hardware such that it does not support access to kernel level services. Hence, need for the existence of virtual machine is not required[14].

C. Nimbus: This Nimbus tool is built on public cloud and it provides the IaaS platform for its clients. Nimbus supports Xen and recently added KVM hypervisors. Platforms for this tool are Java and Python. The structure of Nimbus contain Light weight components[15].

D. OpenNebula: OpenNebula is an open-source toolkit to effortlessly fabricate private, public and hybrid clouds. OpenNebula has been intended to be incorporated with any networking and storage solution and also fits into any obtainable data center. This tool converts data center into agile and flexible virtual infrastructure. C, C++, Ruby, Java, Shell script are the languages that are required to support this tool. The hypervisors which supports this are Xen, VMWare, and KVM. The advantage of this tool is that it supports VM migration[16].

E. Green Cloud: The motivation of Green Cloud is to support the researcher to develop, observe, cooperate and determine cloud performance. The Green Cloud is implemented using C++ (85 %) and (15%) of Tool Command Language scripts (TCL S). The hypervisors which supports this tool are Xen, KVM, and VLAN[17].

F. Amazon web services: This tool is based on heuristic algorithm to arrange applications such as computation cost and data transmission cost. The implementation can be in C++ and hypervisor support is Xen. The tool is flexible, cost-effective, scalable, elastic and secure[18].

G. CloudSim: This is a toolkit developed by the Grids laboratory of university of Melbourne. This is used in cloud computing environments to enable modeling and simulations, it also supports creation of virtual machines of a data centers and migration of virtual machines for reliability and automatic scaling. It is an independent platform for modeling datacenters, service brokers, scheduling and allocation policies. Cloudsim supports modeling and simulation of virtualized cloud based data center for virtual machines, memory storage and bandwidth[19].

H. Cloud analyst: It is developed on the Java platform, it has the features of CloudSim and SimJava.This simulation tool contains very high configurable and flexible features. Cloud Analyst is competent produces graphical output results of simulation in the form charts and tables. The advantage of this tool is that it supports Virtualization (Xen)[19].

I. Eucalyptus: Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs To Useful Systems) is one of the major open source cloud computing tool. It supports private cloud and hybrid cloud and works under IaaS Cloud Services. The languages support for Eucalyptus are Java/ C++, Python, Perl, Shell scripts and also hypervisors are VMware, Xen, KVM[20].

J. Virtual Cloud: In the cloud computing components Virtual Cloud has sub-blocks as a replacement for isolated layers. Some of the resource utilized by virtual clouds is CPU, RAM, Disk I/O and it supports virtual migration. It is implemented in Xml format, Xen. KVM hypervisors supports this tool[19].

K. Open stack: This is suitable for Public and Hybrid cloud. The tool is progressing with improvements to support wide spectrum of requests from the growing user community. It is a single code-base simulator and supports migration. Additionally, this tool supports Data Protection and Data Recovery for VM data. Intel, Cisco, Dell, AMD, IBM, Canonical, HP, SUSE Linux, Red Hat uses Open stack project[21].

Conclusion

With the rapid advancement in the computing technology, the system is more prone to disaster. There is a need to study the tools and analyze how best the disaster management could be achieved in large scale applications. Efficient Disaster management would enhance the reliability, scalability, openness and fault-tolerance of the system, therefore enhancing the overall performance of the computing system. This paper henceforth is aimed towards analyzing the various types of disasters and their probable disaster recovery techniques using the existing simulation tools. This analysis enables the researchers and Cloud Service Providers to comprehend the choice of tools for the development and deployment of their applications, henceforth enhancing the Cloud performance with a better disaster management.

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Tables

Table 1. Popular Tools applicable for Disaster Recovery in the Cloud Models.

Cloud models	Cloud services	Possible Disasters	Tools to handle disasters
Public cloud, Private Cloud And Hybrid Cloud.	Software as a service	DL	AppSim [T1],Google App Engine[T2],Open stack[T12]
		Imp Sch	
		NAR	
	Platform as a Service	DL	Amazon web services[T3], GoogleAppengine[T2], Open Nebula[T4],.
		Imp Sch	
		NAR	
	Infrastructure as a Service	DL	CloudSim[T5],Open Nebula[T4],Cloud Analyst[T6], Nimbus[T7],Eucalyptus[T8], Virtual Cloud[T9], Green Cloud[T10],Abi cloud[T11],Open stack[T12].
		Imp Sch	
		NAR	

DL-Deadlock; Imp Sch –Improper Scheduling; NAR – Non Availability of Resources; T1, T2…..T12 - Tools

Table 2. A Comparison Study of Various Tools Applicable for Disaster Recovery in Cloud.

Tools	Parameters	Platform	VM support
T1.AppSim	Cost, performance, time, Accuracy, Reliability, Response time, Scalability	Java	Not required
T2.Google App Engine	Scalability, response time	Python, Java	Not required
T3.Amazon web services	Response time, cost, Resource utilization, time	C++	Xen
T4.Open Nebula	High scalability, cost, dynamically, VM migration	C, C++, Ruby, Java, Shell script.	Xen, VMWare,KVM
T5.CloudSim	Execution time, Scalability, Cost, Performance, time, Execution time	JAVA	Xen
T6.Cloud Analyst	Execution time, Scalability, Cost, Performance, time, Execution time, Response time, Data Processing time, GUI.	JAVA	Xen
T7.Nimbus	Lower cost, Response time, Reliability, Scalability	Java, python	Xen,KVM
T8.Eucalyptus	Speed, Through put, Response time, Resource utilization	Java/ c++, Python, perl, Shell scripts	VMware, Xen, KVM
T9.Virtual Cloud	Cost, testing efficiency, maximum Utilization, time dependent	XML format	Xen,KVM
T10.Green Cloud	Cost, Performance, Power consumption, reliability.	C++,command language scripts	Xen, KVM,VLAN
T11.Abicloud	High scalability, High reliability, cost, time	Ruby,C++,Phython.	Virtual Box, Xen, VMware, KVM
T12.Open stack	High scalability, Power consumption, higher performance, cost, time	Python	Xen, KVM, UML, LXC, VMware