**Abstract**

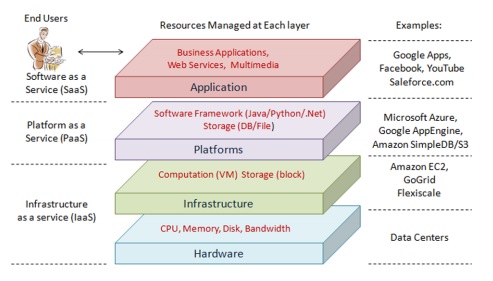
A disaster can strike anywhere, any time. Disaster recovery has a vital role to guarantee business continuity. This research based upon the issues faced by cloud customer in case of any disaster. Private cloud is established when the organization does not want any compromise on its organizational data and resources. The most common causes of disasters in Pakistan are; terrorist attack, flood, earthquake, power loss and network connectivity. In this thesis, existing disaster recovery approaches are compared and analyzed for cloud computing and a new hybrid disaster recovery approach is developed in the perspective of Pakistan having better performance parameters such as RTO, RPO, Cost and security as compared to existing approaches.

**Introduction:**

Cloud environment comprising of a large quantity of shared servers distributed all over the world. These servers provide the infrastructure, platform, devices, software and other resources. The basic theme of Cloud computing is to “pas as you use it basis”. What a system is composed of, is not the concern of the cloud user so Cloud computing is an abstract model of distributed computing. For a cloud user the cloud computing is simply as a black box of software and hardware [1].

Introduction of Amazon’s Elastic Computing Cloud (EC2) in 2006 becomes the first appearance of Cloud computing to the world. In 2007 [2], IBM introduced Blue Cloud at the same time Dell also introduced its version of Cloud computing. After it Microsoft’s Windows Azure and Google’s Map reduce suits are released in the market [3].

Based upon the type of resources assigned to the cloud user’s by the cloud service provider are classified into three service models. They are Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Platform as a Service (PaaS) [4]. Other services offer by Cloud computing are; Data as a Service (DaaS), Identity and Policy Management as a Service (IPMaaS), Network as a Service (NaaS). Figure 1, depicts the three most commonly used cloud services, the resources managed at each layer and examples from real life.



**Figure 1: Cloud computing service model [5]**

A disaster is any unlooked-for incident threatening the personnel, buildings, or normal operational structure of an organization which is beyond the immediate ability of the organization’s staff and normal management structure to control.

The biggest threats to most organizations are from fire, robbery or damage. Serious storms, floods or water escape from other sources can also have a major impact, especially if premises are in low-lying land near a river and important equipment, machinery or computers are sited on the lower floors. Some businesses are at risk from terrorists because of their links with certain overseas countries. And all premises and employees are at risk, from falling aircraft, chemical or nuclear pollution, disease or personal attack [6].

Disaster Recovery has always been about dealing with a single disaster or potentially disastrous situation. Every organization must have a disaster recovery plan (DRP) which is testable, executable, maintainable and scalable. Such a plan must satisfy cost constraints while achieving the target recovery objectives; that is recovery time objective (RTO) and recovery point objective (RPO) [7]. The organizations involved must identify likely events that can cause disasters and evaluate their impact. They need to set the objectives clearly, and evaluate feasible disaster recovery plans to choose the optimal disaster recovery plan.

**Problem Statement:**

Disaster recovery has a vital role to guarantee business continuity. In the case of private cloud computing, the cloud infrastructure and virtual machines running on cloud infrastructure is owned by a particular organization. The management of private cloud is the sole responsibility of a particular organization. Private cloud is established when the organization does not want any compromise on its organizational data and resources. Most of the banks in Pakistan have implement and use the service of private cloud computing. Now a day, unfortunately Pakistan is under the huge terrorist attacks, and these attacks may destroy a complete infrastructure of a private cloud computing organization. Some other causes of disasters in Pakistan are flood, earth quake, power loss and network connectivity. The focus of this research activity is to critically analysis the existing disaster recovery approaches in order to find a clear picture of each disaster recovery plan. After it, a new hybrid disaster recovery approach is presented to keeping view the common type of disasters in Pakistan.

**Objectives:**

The objective of this research work is to develop a hybrid disaster recovery model that is best suitable for private cloud computing environment. The security and confidentiality of data is the main concern due to which private cloud is established. In case of any disaster, the main concern is the security and confidentiality of organizational data so it is not possible to upload the data and application software on any unreliable machine on public cloud. The existing disaster recovery plans are examined so that a better solution should be proposed. The main objective of this research work is to focus the disaster recovery issues in the perspective of Pakistan.

**Research Methodology / Proposed Solution:**

A scientific methodology is adopted to prove this research work. Literature review and background study becomes the base of this research work. To make a strong base of this research work, many different published International Journal papers, conference paper, books, websites, communities and blogs are consulted. The literature review provides a comprehensive picture to disaster recovery related issues and their solutions along with reasoning. After the detailed comparative analysis of existing solutions, a new hybrid solution is presented based upon some standard parameters. The presented approach provides better features in the form of recovery time objective, recovery point objective, cost and security.

**Thesis Outline:**

**Chapter 1**

Introduction (Chapter 1) gives a complete overview of the thesis. This chapter is organized such as thesis introduction, problem statement, research objective, proposed solution and methodology to authenticate the problem statement.

**Chapter 2**

Background and Literature Review (Chapter 2) gives a brief overview of the research area. This chapter is organized such as background of Cloud computing, Cloud computing service models, types of Cloud computing architecture, types of disasters in Pakistan and disaster recovery plans.

**Chapter 3**

Problem Statement and Proposed Approach (Chapter 3) presents the research problem statement under consideration and the proposed approach to provide a solution of problem statement.

**Chapter 4**

Research Methodology (Chapter 4) discusses the scope, objectives and the approach used to solve problem under study. A scientific approach is used to propose a solution of research problem.

**Chapter 5**

Implementation (Chapter 5) presents the implementation details of the proposed solution and analyzes different disaster recovery plans as an example of the problem under study.

In chapter 5 implementation, implementation examples, of proposed solution as well as study and analysis of different problem under this scope are discussed.

**Chapter 6**

Conclusion (Chapter 6) discusses the objective of the thesis and how well the thesis achieves its objective by providing proposed solution and the benefits obtained.

**References:**

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Respected Sir,

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