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## EXPANSION OF ARCHITECTURE CLOUD STORAGE WITH SNAPSHOT AND DISK-TO-DISK IN CLOUD COMPUTING

HATEM. Taha<sup>\*1</sup>, Ali. Manea<sup>2</sup>, El KADRI. Kamal Eddine<sup>3</sup> and NOURA. Aknin<sup>4</sup>

<sup>\*1</sup>Laboratory of Computer Science, Operational Research and Applied Statistics, Abdelmalek Essaâdi University, Faculty of Sciences, Tetouan, Morocco

<sup>2</sup>Department of Informatics, Faculty of Engineering, Sana'a University, Sana'a, Yemen

<sup>3,4</sup>Department of Informatics, Laboratory of Computer Science, Operational Research and Applied Statistics, Abdelmalek Essaâdi University, Faculty of Sciences, Tetouan, Morocco

### ABSTRACT

Recently, cloud storage service (STaaS) have become a very popular where there are many Cloud Storage Providers (CSPs) for this service, with the increase in their users (Cloud Storage Customers). This paper introduces an expansion method of cloud storage architecture with snapshots and D2D; the proposed method is a simple, sophisticated and robust version of the architecture cloud storage in the fourth layer of the architecture proposed by Talasila Sasidhar. The proposed system adopts a simple approach by adding controller option for Snapshot or Disk-to-Disk, the that can be used to steer users toward a particular option for saving data in the backup technology and as well as can be distributing or saving them in the same layer or in the other place. In addition, it also simplifies the deployment and management of snapshots with D2D and disaster recovery, as it finds its way into every storage management toolkit. Generally, the present method is related to layer backup cloud storage, backup technology more particularly, to a method snapshot and D2D system for storage and management of snapshots in a cloud storage architecture and creation of Backup. In this article, we aim to support various aspects in the backup technology of architecture cloud storage environments which would enhance backup services and the reliability of a cloud storage system. Also that can provide information that is useful for further research in this area from our point of view.

**Keywords-** STaaS: Cloud storage service; Backup Technology; Snapshot; D2D: Disk-to-Disk.

### I. INTRODUCTION

Cloud Computing is everywhere. It isn't just about accessing applications over the web. It can be almost anything, such as, it used for collection of data in the context of security or data management. So we consider to have the cloud computing will be the primary source for all of the IT services, such as our first source of file storage (Images, files, documents), to deploy services, to share and to backup data. As we see, there is no specific description of this service, but its plays a big role in the arrival of services to the consumer by use virtualization technology. As shown in the figure 1.



Figure1. Cloud Computing

These services are in general divided into separate layers: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) commonly known as Storage as a Service (STaaS), In this layer, and through which users can rent or buy space for their data stored and access them anytime from any place [1], according the terms of the Service Level Agreements (SLA) where the services are formally defined. It is also one of the most important of the solutions associated with the challenges of backup data. This means, these clouds are the optimized, economic, scalable and stable fast, flexible and dynamic, rapids or automatic provisioning and multi-tenant secure, scalable to minimize costs, etc. As shown in the figure 2.

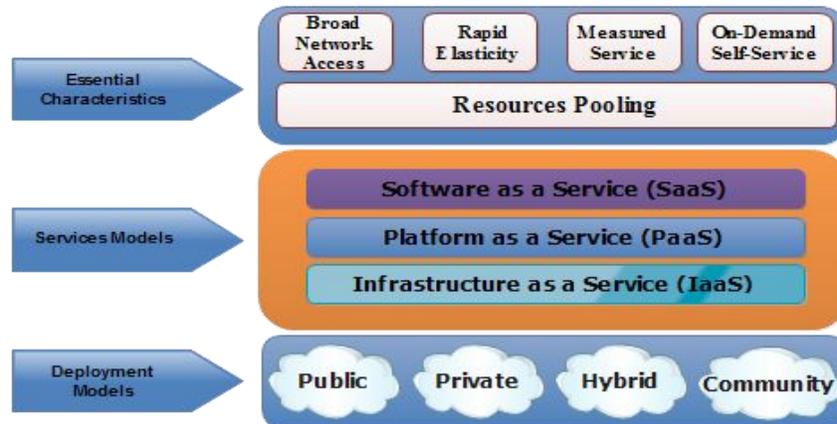


Figure2. Cloud computing: everything is a service

There are many observers and researchers who have used the phrase Storage as a Service (STaaS) to describe this type of storage service, which is expected to post a CAGR of 37.96% from 2014-2019. This increase is due to the creation of data backup and archiving services worldwide according to 451 research [2]. Cloud storage is one of the cloud computing-based services, which provides remote storages and management operations for resources. Also, data in the cloud storage has become the latest trends in Internet data storage. The idea is confusing and interesting. This article explains only the fourth layer in the cloud storage architecture, and how users can benefit from using it. Thus, backup is one important aspect of the cloud storage services, which provides the ability to restore data in the event of any disaster, occasionally without the need for specialized backup servers.

On the face of it, we are seeking hybrid solutions which could enable users cloud storage to control methodology of keeping its statements and management, and raise the level of confidence they have in the proposed architecture of cloud storage. They are flexible and practical methods for keeping data and their services while reducing the costs associated with service delivery. Generally, this method is useful when evaluating architecture of cloud storage, and to improve storage efficiency, performance, reliability, and compatibility. Also, it's an unbiased method because it accurately reflects the controller between the snapshot and the D2D to which the backup relates. On the other hand, it has comparative advantages in terms of designing.

## II. KEY TECHNOLOGIES

### STORAGE-AS-A-SERVICES (STAAS)

Storage-as-services: are systems which provide storage services to customers via the Internet that use virtual technology (virtualized storage device). Integrates various storage devices of the network by a different application, which use a large amount of network bandwidth required to conduct storage. Cloud storage provides many different access interfaces for all application cloud storage architecture. In general, users can access cloud storage to store and retrieve data using web services protocols, such as REST or SOAP. The services online backup is the most developed application in Cloud storage service (STaaS), but It faces challenges relate to the internet service, which we will study it in the next search, such as performance, scalability geographic, network security, availability and data encryption [3].

Cloud storage can provide high reliability and security storage service at competitive price. Also, customers have the option to trade the privacy of their data for the convenience of storage services [4]. There are more than 60 CSPs (cloud storage providers) that deliver economies of scale by using different storage capacities to meet the needs of many organizations, passing the cost savings to their customer base, such as Amazon, Google, Microsoft and Dropbox. It can be an acceptable solution to keep up storage infrastructure and additionally to mitigate the risk of the data loss just in case the disaster. All customers know that there is a need for maintaining simplicity, scale back data storage prices, freedom from vendor lock-in, improve availability data, continuity and sensible performance.

From this groundwork, we see this may provide an opportunity for some emerging enterprise with growing their data. Also, this may be an effective solution which store resources in the cloud for government, enterprise and users. These users can at anytime, anywhere, through any device connected to the Internet cloud and easily access the data. In terms of work, there are a lot of problems and challenges exist.

### III. THE NEED FOR A CLOUD BACKUP

Digital information and equipment are subject to loss, theft or destruction, data loss has been caused by hardware or software malfunctions or a virus activity. In that context, a special attention needs to be directed in particular to the protection of data. Backup is committed to help you. Backup, whether local or offsite maintains a redundant copy of an organization's valuable data in the event of a system failure or natural disaster as well as retains data to fulfill compliance requirements and litigation requests. Apart from that, backup is essential to provide a cost-effective file storage and backup solution for every user. It is for example, possible for any user to delete any important file or images that are difficult to find, or retrieve easily. This backup shall be a safety valve that is a precaution against data loss caused by any problem. Furthermore, it also ensures the safety of your files and to restore a previous version of your files or to retrieve deleted data in the storage system, or to change service providers.

For all this, cloud storage service providers (CSPs) should understand the importance of growing and evolving to meet the demands of the cloud storage customers they serve today as well as to proactively plan for the needs of their customers in the future and questions that require further clarification include the operational benefits and the associated costs, as well as the solution of risks. This Information needs to be presented in a way that allows of cloud storage customers to take the right decision with full confidence to exploit the storage cloud services.

Today, companies and customers at the cloud storage service need reliable, rapid and affordable storage solutions to fulfill their ever increasing storage needs, to backup critical business data and disaster recovery solutions, and to ensure a continuous availability of their data. There are many benefits and challenges in services backup in the cloud storage.

- Benefits of the Backup in cloud storage
  - 1- Recover data after its loss
  - 2- Increased availability
  - 3- Recover data from an earlier time
  - 4- large number of cloud service providers (CSPs)
- Disadvantages of the Backup in cloud storage
  - 1- A pay-as-you-go billing model
  - 2- Security is a major concern.
  - 3- Reversibility of service
  - 4- Economics - vendor lock-in

There are many companies providing cloud-based storage, backup and online backup, but those services must also remain affordable for everyone.

#### IV. CLOUD SNAPSHOT

In this section, we would like to provide the reader a quick outline of some uses snapshotting generally, to understanding the opportunities and addressing a broad array of interconnected challenges for structure of cloud storage. We will describe the snapshot cloud in architecture cloud storage and explain its underlying challenges at the core issue in backup and recovery. In any storage system, the protection of data is probably one of the most sensitive issues. More generally speaking, a snapshot is the state of a system at a particular point in time. High-availability systems may instead perform the backup on a snapshot that is a read-only copy of the data set frozen at a point in time and allow applications to continue writing to their data. Snapshot could also provide another data access channel to accelerate I/O performance. It can therefore be said that the snapshots in the cloud storage system are used to avoid downtime, snapshots technology look and behave like complete backups. [6] There are a also large number of vendors offering different methods for exploiting snapshot to management, use, storage simpler, and consequently, more reliable. To give just two examples: Data Tiering and Remote Replication, these two are prime examples and crucial to any storage system [7] and [8].

#### V. HOW SNAPSHOTS CLOUD ARE USED

Users must identify what they require of their cloud storage providers (CSPs), and to do this they must have a better understanding of how making use of cloud storage. In the context of this work and with a view to getting a snapshot of some types of snapshots, there are different methods adopted by vendors to create snapshots, each one having its own benefits and its drawbacks. Therefore, it is important to understand snapshot implementations. In a concise manner we will present the primary ways in which snapshots can be incorporated into the cloud storage architecture to enhance data security.

**Snapshots used** in shadow-paging file systems. As NetApp WAFL and Oracle Solaris ZFS, Hadoop Distributed File System (HDFS). This also allows the administrator to create a new block device and to modify data, and to overwrite the old data of a logical volume. While there are a number of mechanisms that can protect the old data, for instance, **ROW “Redirect-on-Write”** Redirect-on-write is comparable to copy-on-write. This work focuses on the context in which copy-on-write is produced and modified. Likewise, this reduces the number of writes from two to one, which has to be written in new places and this is one of the most important challenges because the original data set can quickly become fragmented. However, with redirect-on-write, the original copy contains the point-in-time data, that is, snapshot, and the changed data reside on the snapshot storage [9]. While **COW “Copy-On-Write”** Which allows the user makes changes to the same data "copy of the data", that they may occasionally need to modify the same resource, with the preservation of the original resource unchanged. Furthermore, make significant resource savings by sharing resources [10]. The main job of snapshot cloud is to backup or recover data. However, this presents some challenges, particularly in the working long-term and the numbers of snapshot with these technology [11].

#### VI. CLOUD DISK-TO-DISK

In the past few years, Solid State Drive (SSD) has started making its inroads into the enterprise IT environment and which contributed to reducing Hard Disk Drives (HDD) as a storage technology was widely used in the enterprises. For this reason enterprises need higher input/output (I/O) performance.

Wherefore, we see that the cloud storage is hybrid approach combines new technology and traditional that used to reduce burdens for enterprises especially in the start-up phase, also to protecting the customer's data so that it could be extensively used in storing data and sharing. In response to these issues some innovators in this space are blending the capabilities of traditional onsite backup systems with cloud storage. This is even more important now, to ensure continued industry trend toward using disk-to-disk (D2D) backup for more frequent and timely data protection for the cloud storage system. In addition, the combination of all these innovation provides maximum protection for the customer data in cloud storage.

For that, We need a cloud storage is accessible to all, safe and scalable, with offsite backup for any data or any system anytime, anywhere, which means access to cheap store services for customer. Furthermore, we see that these requirements may be realized in the technology Disk-to-Disk which is gaining in popularity in both large enterprises and small businesses. There are in fact a number of hybrid solutions with some hybrid cloud backup tools today,

such as, Acronis Inc., CommVault Systems Inc., and Symantec Corp **Error! Bookmark not defined.** There are some advantages of Disk-to-Disk (D2D) than Snapshot, include the following:

- Lower cost due to lower hardware requirements, also management costs;
- Support by all major applications for backup protection;
- Obtain data transmission high speeds.

### VII. DISASTER RECOVERY AS A SERVICE (DRAAS) [13] and [14]

**Disaster recovery** as a service (DRaaS) or cloud Disaster recovery (DR) can mean different things to many different cloud customers, such as specific technic set of good practices by different technology and across organizational boundaries through connections built in cloud storage networks, including backup, recovery infrastructure, configure, restore, reload, rollback, and restart. Moreover, immediate access to cloud data from any different location when it comes to cloud disaster recovery (DR). The previous research in this area that has focused on broad definitions of disaster recovery shows that this is a persistent problem in IT platforms. Cloud disaster recovery is a simple solution and the best alternative to replace or enhance traditional recovery methods.

In that regard, a few specific challenges could arise. firstly, key challenge facing some cloud storage architectures is in providing disaster recovery as a services (DRaaS) which requires software to any recover full or partial operation shortly after a disaster occurs, secondly, the reduce the risks of data loss and the administrative burden.

According to Forrester, nearly two-thirds of companies have already adopted, or are poised to adopt, disaster recovery as a service (DRaaS), and this has badly affected the cloud storage for different reasons. For example, a lot of reliable service reduces the chance of knowledge loss, cost, speed recover servers, data, disks and applications. Hence, cloud storage role in disaster recovery solutions can increase as cloud capabilities evolve and also the use of cloud technologies becomes progressively widespread. This is particularly helpful for little or medium-sized businesses, as cost, convenience and provide solutions of disaster recovery would create ease for retrieve information and integration of databases at any purpose in time.

In this regard, in May 18, 2011, Forrester Research “*Defines DRaaS as prepackaged solutions that provide a standard DR failover to a cloud environment that you can buy on a pay-per-use basis with varying rates based upon RPO and RTO.*” and “*Defines cloud-based DR solutions as falling into one of three main categories: do it yourself (DIY), DR-as-a-service (DRaaS), and cloud-to-cloud disaster recovery (C2C DR)*” [15]. Each model incorporates a distinct set of advantages. Based on speed and cost, customers will opt for the acceptable model. As shown in Figure3, it will serve DR with low cost and high speed.

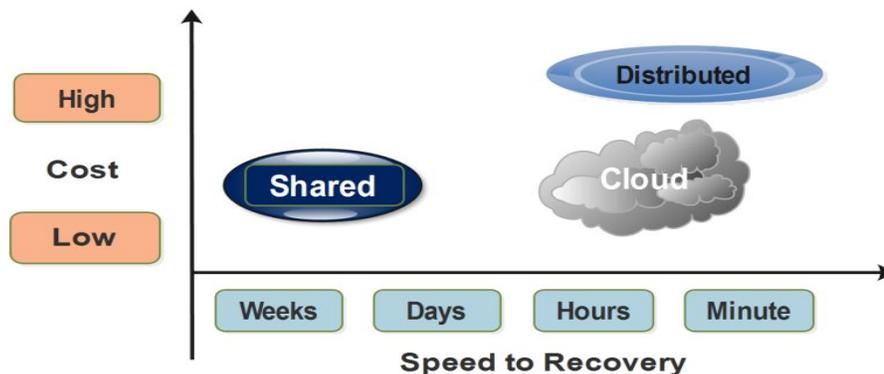


Figure3. Comparison between traditional and cloud DR models (IBM White paper, 2012)

According to IBM research, only 50% of disasters in IBM are caused by weather and the rest are due to other causes, such as damaged power lines, server hardware failures and security breaches.

### VIII. BACKGROUND AND RELATED WORK

The cloud storage is characterized by different service providers, plenty of services to choose, increased customers data, buy on a pay-per-use basis with varying rates based upon RPO and RTO. As data volume is continue to grow exponentially, the cloud storage system become more and more interested during recent years, particularly identified the benefits that the cloud storage system providers as the cloud customers in cloud computing. As traditional infrastructures do not provide any tools for keep pace with this development and the increase.

There are many different organizations and researchers who have agreed to some extent to the naming structure of layer cloud storage. Through these researches, they have defined in the context of cloud storage architectures, which consist of a front end that exports an API to access the storage. In traditional storage systems, this API is the SCSI protocol; but in the cloud, these protocols are evolving. There, you can find Web service front ends, file-based front ends, and even more traditional front ends (such as Internet SCSI, or iSCSI). Behind the front end is a layer of middleware that I call the storage logic. This layer implements a variety of features, such as replication and data reduction, over the traditional data-placement algorithms (with consideration for geographic placement). Finally, the back end implements the physical storage of data. This may be an internal protocol that implements specific features or a traditional back end to the physical disks [16]; [17] and [18].

Many technologies have been developed to accommodate this kind of increased data based on different techniques, as there are many articles introducing how to choose new cloud storage services. A comparison was conducted by Sara Mitroff in which she compared the most well-known cloud storage providers (CSPs), including OneDrive, Dropbox, Google Drive, Amazon Cloud Drive and Box [19]. She compared the store space, provide backup files, their strengths and weaknesses and functionality of different providers. Developing cloud storage architectures suffer from incompatibility and complex that makes the biggest challenge facing the implementation of some proposed systems for cloud storage management. The images shown in Figure 4 were taken from an article [16], and they illustrate the different layer construction of the architecture of cloud storage.

According to Talasila Sasidhar, Pawan Kumar Illa and Subrahmanyam Kodukula, *“Cloud storage providers are providing various storage options and they mainly focus on storage logic and this storage is on demand as well as elastic so the cost is calculated as per usage. But if we consider the backup technology they treated as separate service. If we want to back up huge amount of data some technical synchronization issues are arise. So that I include the backup technology in general cloud storage architecture only as shown in Figure 4. The advantage of this type of architecture is we can easily monitor the Snapshotting mechanisms and Disaster Recovery, so the synchronization problems are solved when we taking backup rapidly.”*

Snapshot technology function is a simple and convenient way to back up our data which protects the old one. This technology will allow several users to keep all their data, or even to find at the end of re-writing them, by using known methods and existing tools in a Copy-On-Write (COW) and Redirect-on-Write (ROW). However, we would like to make it very clear that there is no question of the snapshot system. If there is a problem, it is in the number of snapshots when we have more than 6,000 snapshots, which makes it more difficult to maintain an old data and perhaps modern. In addition, we need to have more than just one method of backup, including hybrid solutions. In addition to all the above, there are some most important problems:

- High numbers of snapshots versus high costs;
- Snapshot lacks the ability to fully substitute backup systems.

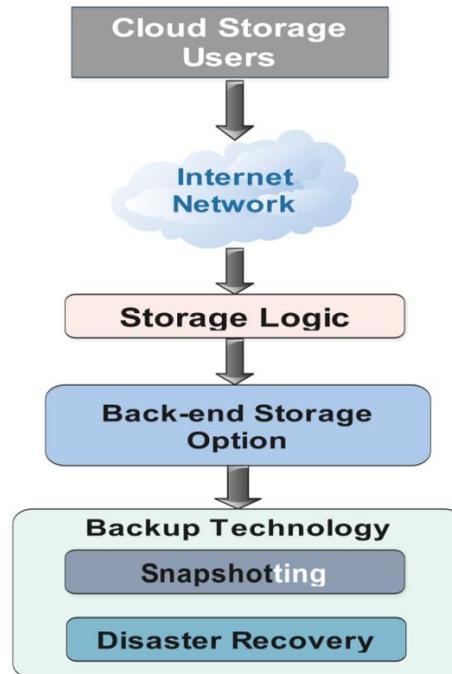


Figure4. A Generalized Cloud Storage Architecture [16]

What we can say, that the Backing up is fundamental to all IT users to practice permanently, particularly the data that are permanently exposed to loss or theft or malfunctions. And also the user might mistakenly delete some data, for example, is not limited to important images and in other instances when it is difficult to retrieve. However additionally, to change cloud storage service providers (CSPs). Despite the existence of real obstacles and problems to make up for the first reserve backup which an essential part of the cloud storage strategy. But we consider the snapshot technology and disk-to-disk (D2D) are important factors in backup technology.

**IX. POTENTIAL SOLUTIONS**

In this section, we'll discuss our architecture that has been proposed to overcome the problems and challenges in the fourth layer (cloud backup technology) of architecture cloud storage. This is based on a cloud Storage Model within the article [16] by Talasila Sasidhar. As Figure 5 shows, it's contains four layers: Cloud Storage Users, Storage Logic and Back-end Storage Option, Cloud Backup Technology. In the fourth layer are used two technologies for backup (snapshot and Disk-to-Disk) in backup technology layer, Snapshot and Disk-to-Disk that are composed of the rules of control and applications for storage data.

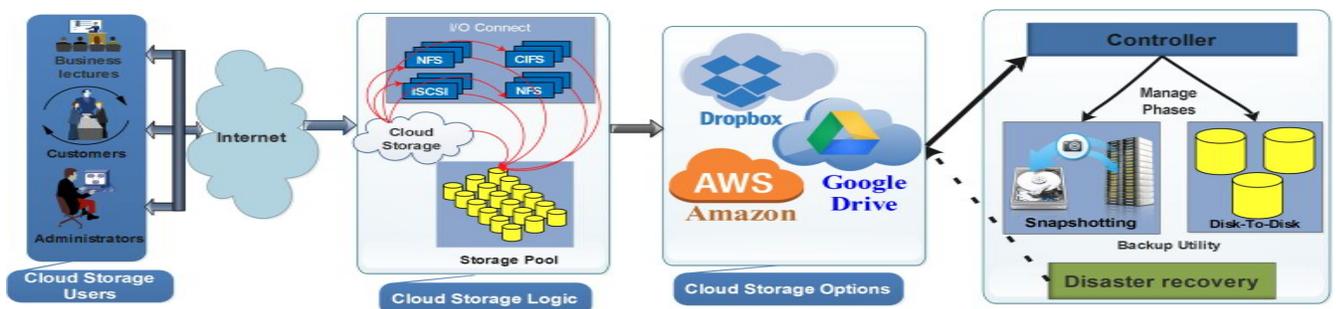


Figure 5: Architecture cloud storage -- Zoom Level 2

As an example of a Cloud Backup Technology Layer, we discuss the new evolution of a Cloud Storage Architecture. In this architecture, we tend to divide this layer into three layers, in the first upper layer we provide the Controller; in the middle layer we provide two technologies of backup, namely Snapshot and Disk-to-Disk for choice of different methods of storage data in cloud storage and in the third layer we redesigned disaster recovery, so that the synchronization problems are solved when we take backup rapidly. This can be shown in Figure 6.

The controllability helps their users to choose and manage Storage Technology, either the snapshot or disk to disk. Also, this controller has special applications, which enable user to choose the method that works best for him: such as the applications, manage database, and storage options through a web service application programming interface (API), which is provided through cloud storage service providers (CSPs). Access and manage operations are defined as in any cloud storage system. When a user selects the provider of cloud storage services, the user must determine which requests will be sent to the provider, including technology backup.

The architecture is interesting because it runs two backup technologies. There is a need for increasing of customer's confidence in order to improve knowledge of architecture cloud storage, its advantages as well as available options to optimally use of cloud storage system. So, we have designed and distributed the options storage, which that is implemented upon cloud backup technology layer in the architecture cloud storage. We've designed the following method to help demonstrate the variety and flexibility of the storage options which offer by cloud storage providers. It's also a great solution when used as an independent copy of the data volume in the cloud in one or two of the technologies, changes in volume automatically and enable restore and synchronize the data in the event of a disaster.

This controller with Snapshot and Disk-to-Disk (D2D) can be used in place of a traditional data backup system in the cloud storage system. Snapshots and Disk-to-disk (D2D) provide significantly easier, reliable, cost effective, automated, and faster backups than any traditional backup system.

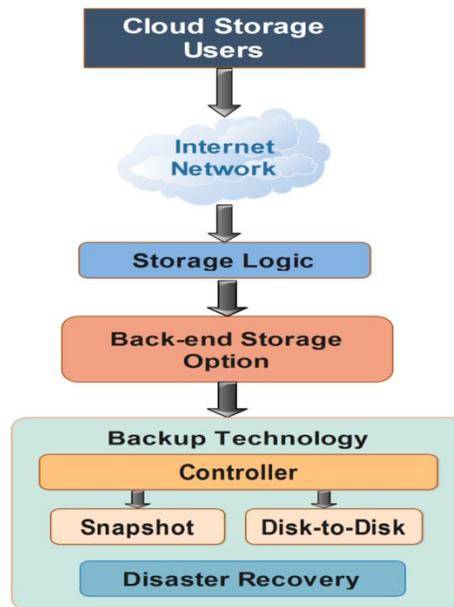


Figure6. The new evolution architecture cloud storage -- Zoom Level 1

This is a form of architecture cloud storage where data files are stored on multiple technologies. These technologies used for cloud storage are typically hosted by cloud storage providers (CSPs). The advantage of this, when user subscribes to a cloud storage service, user can lease one or two kinds of technologies backup from the backup cloud storage, which can access via the API. This model to improve functionality of cloud backup layer, we can choose any type of technology, or both according to the data storage management method or the moving of our interests in the Cloud Storage.

Additionally of the benefits of this kind of design are: employing a large choice of applications; providing varied storage options; likewise as elastic therefore the cost is calculated as per usage; can be configured before or after using any backup service; providing Higher quality services, owing to the likelihood of improved processes and technologies both; finally, it provides a regular backups and recovery is simpler.

## X. CONCLUSION AND FUTURE SCOPE

Cloud computing is a storage system where users in different domains can store data in the cloud storage. It is important that hybrid solution adapted to the needs of customers, who already have big data and seek better results and better security for their databases, should reduce their costs, to be a core element of the cloud storage strategy. This is because the hybrid solution has proven to be a sustainable solution to old and new challenges for all these cloud storage providers (CSPs). The discussion and practical proposal of the second part of the Architecture cloud storage will be provided in the future work. In this paper we mainly focused on backup technology that is used by the existing cloud providers.

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