Analysis of multi cloud storage applications for resource constrained mobile devices[☆]

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Summary Cloud storage, which can be a surrogate for all physical hardware storage devices, is a term which gives a reflection of an enormous advancement in engineering (Hung et al., 2012). However, there are many issues that need to be handled when accessing cloud storage on resource constrained mobile devices due to inherent limitations of mobile devices as limited storage capacity, processing power and battery backup (Yeo et al., 2014). There are many multi cloud storage applications available, which handle issues faced by single cloud storage applications. In this paper, we are providing analysis of different multi cloud storage applications developed for resource constrained mobile devices to check their performance on the basis of parameters as battery consumption, CPU usage, data usage and time consumed by using mobile phone device Sony Xperia ZL (smart phone) on WiFi network. Lastly, conclusion and open research challenges in these multi cloud storage apps are discussed.
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Introduction

Storage is considered as one of the biggest expenses of Information Technology (Gartner, 2012). As the data grows in all enterprises is increasing almost 50% every year, so around 30% capital expenditure of each enterprise is used for storage. To overcome this, the concept of cloud storage came into existence and it ranges from an end user to an enterprise. Cloud storage is provided by a third party known as Cloud Service Providers (CSPs) on a pay as per usage model means end user or enterprise have to pay money to the CSP as per the usage of their resources as storage. The main advantage of this concept is that the initial cost of the end user or enterprises is reduced means they do not have to purchase the H/W, no maintenance cost as all of these resources will be provided by CSPs at very low cost. It another main feature elasticity enables the user to use as much storage as he needs and release it when it will free. The main idea behind low cost cloud storage is that CSPs provide same storage to different organizations and end users when and where they will need it. As per NIST, cloud storage is ''a model for enabling convenient, on demand network access
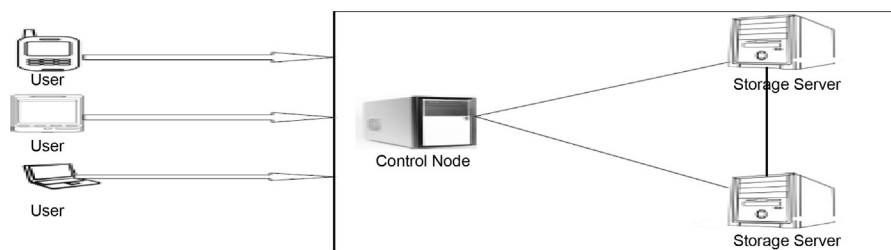

Figure 1   Architecture of cloud storage (Go and Kwak, 2014).

to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction''. Different service models of cloud are

- Infrastructure as a service
- Software as a service
- Platform as a service

Cloud storage services give on-line storage wherever knowledge is holding on in virtualized pools of storage hosted by third parties, sometimes spanning giant knowledge centres in numerous geographical locations. The service may be simply accessed by users from anyplace, throughout anytime and victimization any device, via internet association. The thought has developed into craze throughout omnipresent information gain access to and it is revolutionized the approach users gain access to their own personal information, by reduction of the will to stay during a person's person outside safe-keeping gadgets all the time. It is been recently, largely assigned to the particular more and more need of users to share content material along with the expectation to obtain steady use of their own info making use of numerous research gadgets for example Smart phones Tablets. In addition, it has developed into practical back up, file discussing in addition to cooperation answer.

This paper gives an analytic overview of different multi cloud storage applications. Section ''Mobile cloud storage architecture'' provides cloud storage architecture for mobile devices. Section ''Multi cloud storage applications: requirement and features'' presents the requirement and features of multi cloud storage applications. Section ''Results of analysis of multi cloud storage applications'' presents the results of the experimental analysis. Finally, we summarize and conclude the analysis in section ''Conclusion''.

Mobile cloud storage architecture

Go and Kwak (2014) suggested a cloud storage architecture, in which a great deal of storage devices is grouped together by network, middleware and distributed file systems to provide cloud storage services to enterprises and users. The different elements used to prepare cloud storage are distributed file systems, service level agreements, storage resource pools, and cloud storage service interfaces. Accordingly, there are many cloud storage providers available, some of them are used for some specific purpose like storage of photos, e-mails and some are used to store all

sorts of information. Architecture for mobile cloud storage is shown in Fig. 1. In this architecture, mobile device are connected to the cloud storage through a controlling node. To store/access data from a cloud storage provider, user sends a request from mobile devices through the fluid application of that particular cloud storage provider and CSP perform the procedure as per user request. The control node is used control the whole cognitive process. Nevertheless, in this instance, the user has no control on his data as it is salted away in a distant position. Therefore, there are issues regarding security and secrecy of information that need to be taken care. Even when cloud storage services are accessed by resource constrained mobile devices, there are many issues which are faced by the users, needed to be taken care.

Multi cloud storage applications: requirement and features

Hung et al. (2012), the multi cloud storage applications are required to access multiple cloud storage services on mobile devices. Some mobile companies add cloud storage application in their devices (Mobile Cloud Storage, n.d.). These applications provide synchronization of user data (text/graphic) for different operating systems. E.g. iCloud cloud storage application is provided with Apple iphone, ipad, etc., similarly, Google provides GDrive for mobile devices having android platform, Samsung has a partnership with Dropbox and Microsoft devices are equipped with SkyDrive. But accessing these different applications for each cloud storage provider on resource constrained mobile devices are awkward and it would be wastage of storage space of mobile devices (Multiple Cloud Storage, n.d.). As we know mobile devices already suffer with constrained resources such as storage, processing capability and battery power, so accessing different cloud storage applications for different storage providers is not a good idea (Yeo et al., 2014). Therefore, to access multiple cloud storage services on a single interface, there are multi cloud storage applications that provide the facility to handle services provided by different cloud storage providers on a single interface. The characteristics of some of these multiple cloud storage applications are given below in Table 1.

Results of analysis of multi cloud storage applications

In this section, we have furnished the results of comparison of three multi cloud storage applications, multi cloud storage prototype, ES file explorer, cloud cube — multi cloud