Major Issues and Challenges in Energy Efficient Cloud Storage Service

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ABSTRACT

Cloud computing is considered as the delivery of various services via internet including data storage, severs, database and networking software. This helps to save file in remote database and retrieve them back again. Some of the common example of cloud computing which includes Google App Engine, Apple iCloud, and Microsoft online. Even the email, online banking, social media and online shopping is also the known example of cloud com- puting. Some challenges of cloud computing is considered as security, privacy, cost, lack of resources especially energy resources. Awareness about energy is considered as the biggest challenge for cloud computing system because adaption of cloud computing with increase in cost for energy. Cloud computing is achieved through distributed data centers which con- sumes a significant amount of energy. This research paper focus on how to bring in changes in the data centres regarding energy-awareness and the process of lesser energy consumption. It is done through analysing several review of literatures and primary challenges in energy-savingareanalysedforutilizingtheminthecloudbasedstorageenvironment.

Keywords
Cloud Computing, Storage Service, Energy Efficiency, Distributed File Systems, GreenComputing.

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Introduction

[1] the present advancement and up-gradation in smart technologies which is getting sig- nificant attractiveness and recognization among its users which results in huge data generation. Forecasting 75 B devices is a bigger thing when compared to the world population it is 10 times bigger.
[2] Theannualsizeofthedataworldwidewillriseupto175ZB.
[3] It is found that nearly three hundred and thirty-one Billion have been invested in the cloud-basedsystemtill2023thisisrepresentedinfig1.
[4] This development cannot be achieved only through proper infrastructure along with it ideastoprocessandstoringincomingdataisrequired.
The integration of AI in smart device makes data storing process more complex. The cloud-basedstorageanditsstudyareamustbeexploredtounderstanditin betterway.Fig1represents thedevicesandcostforcloudcomputing.
[5-9] In this present situation many embedded device are connected with internet to observe and connect with all system.
[10-11] With increase of data in internet, the process of analysing and storing it using con- ventional method is a biggest challenge.
[12-14] Many researchers are trying hard to design a new version of the database with the NoSQL database to manage non-structured data.
[15-18] The multi-model database management system designed to support multiple data against a single backend.

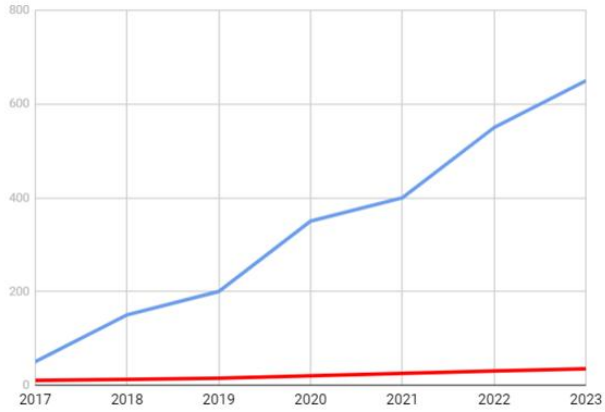

FIGURE 1 Thecloud devices and revenue forecast

[19-20] With the arrival of newer technology and computing techniques many organization tries to utilize them in their organization.
[21-24] Setting of system at wide range needs more effort and investment plan.
[25-26] The users are not provided with full control on the computing system which are available in the internet.

Many researchers are focusing on the cloud-based storage system due to reason that the new version of apps requires more storage space and the data for utilizing it is also higher at the same time. The concept of On-demand storage is that when the commercial organization which works for anothercloud-service.
[27-30] The one who provides storage are focusing on cost, performance, and multi-storage capacity of the cloud-storage system. The fig 3 brings the master structure for data in the cloud- based storage system.
The model of data centers is based on Design –for –failure concept in cloud computing. The design –for –failure represents the system errors and building software to heal them. The global cloud storage system requires scalability, cheaply built solution. These solutions may require various

hardware like servers, network equipment, and system storage. The "off-the-shelf" is the one designed for mass production, and the one can be used for the immediate purpose. This will not be fit enough for using them in the cloud-based data center. They are highly costly and donotmatchwiththerequirementsofthecloud-baseddatacenter. This research is represented in various section and the main issues and challenges for energy efficient cloud-based storage device. This paper is categorized into various sections to point out the study in a well described manner.

Cloud StorageArchitectures

Cloud storage architecture is how all the components and capacities necessary for building a cloud are connected in an order to deliver an online platform on which the applications can run. This consists of API (Application Programming Interface) which access the storage space. In the conventional system storage, the API is considered as SCSI (Small Computer System Interface) protocol. The front end is the user interface. The SCSI protocol is the set of standards that are used to connect and transfer data between the computing devices.
[31-32] this SCSI consists of several features such as imitation and data reduction, in the conventional data algorithm. The back end is the one that works behind in order to provide information to the one who is using it. This SCSI is the inter protocol that gives the back end work to thedisk.

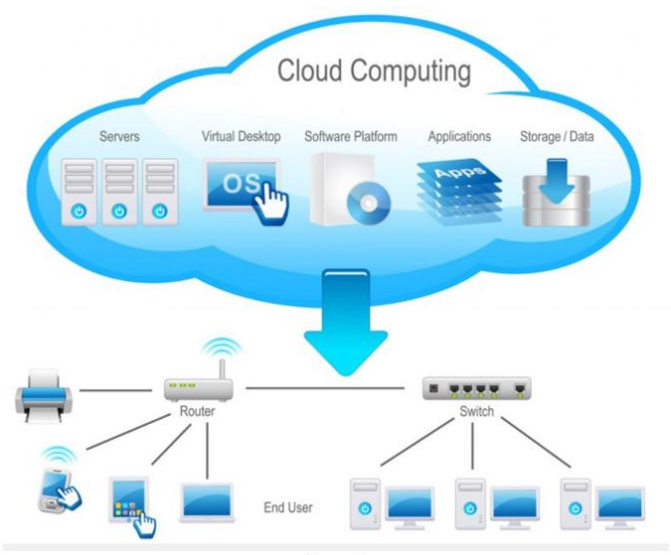

FIGURE 2 Structure of cloud storage

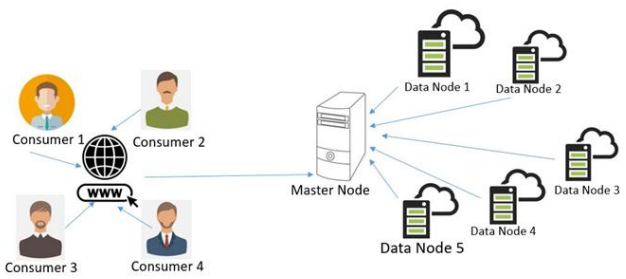

FIGURE 3 Master and data node in cloud storage architecture

StorageintheviewofServiceCloudDesign

3.1 Security

In cloud computing security and virtualization are considered opposites. The cloud security is the set of application, and technology which helps in protecting the virtualized Internet proto- col. the virtualization is the one from hardware and network bounds but security is the one used for establishing those boundaries. Security must be considered while designing the virtualized environment.

FIGURE 4 Cloud Security and Access Method

3.2 Automated Information LifecycleManagement

The ILM known as the information lifecycle management is considered as the best way to manage data in the lifecycle. It is the strategy in administrating the storage system in the cloud computing-based device. The ILM has all records of data from the beginning to the end. But many Information lifecycle management does not always achieve its goal. Till today the ILM wasnotimplementedinalargecloud-basedsystem.Thereasonforthisisbecausethemediain the cloud is in the bottom tier of the ILM. Without the lower tier for the movement of data, the ILM cannot be utilized.
The implementation of ILM is cost-efficient and more complex in the cloud-based economy. It is found that nearly 70% of the data is fixed. With the perfect data in the correct media, the enterprise has the possibility of cost-cutting. With the savings in cost now the utilization of cloud computing and the economic benefit of the implementation of information lifecycle management in the cloud-based system is important. This should be done without additional or breakageofapplicationwhichbringunnecessaryprobleminthes ystemoperation.

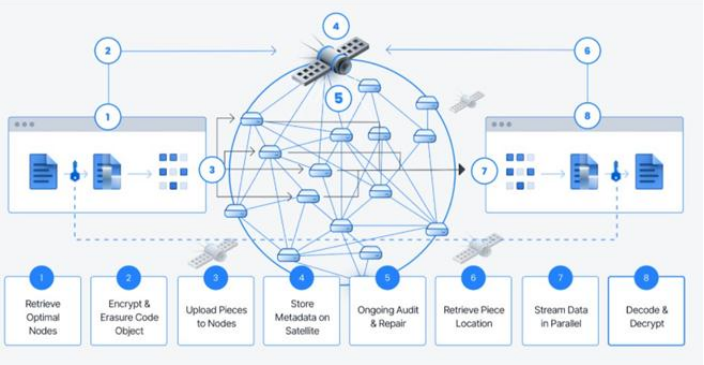

FIGURE 5 CloudStorage reference model

3.3 Storage AccessMethod

Fig 5 represents the cloud storage structure where 3 main ways are available for accessing storage space in a cloud-computing system. The block-based SAN (Storage Area Network), the file-based CIFS (common internet file system), and Web-based services.

The block-based and file-based services are found in enterprise design, which is the reason for producing greater performance, availability, and security. The data in the cloud-based system are accessed through Web-based services like the Simple Object Access Protocol (SOAP) and Representational State Transfer the REST. All these access methods can be used to support cloud-based application structure.

3.4 Availability

The IT windows have been rejected because the enterprises need to encourage their users in a multi-level time period with availability all the time. Anyhow Cloud Service-level agreement canbeutilizedforavailabilitybutisdifficulttomeasurewhencons ideredfromtheperspectiveof business users. This is because of the cascading effect- the effect which causes a negative impact on the system. The Input/Output (i/o) performance in a massive marker cloud-based system is the best one. When the cloud-based structure is depending on the part of the infrastructure which is not controlled by the internal IT, then reducing the infrastructure components and its paths are the best choice in weakening the risk of downtime. The cloud-based system tries to always increase its availability but the needs of the enterprise are not met sometimes as they havecautionthateliminatesthesituationoutsidethecloudprovid er'scontrol.

3.5 Primary DataProtection

The primary data supports online processing. These primary data can be protected using single or multi-techniques. The methods used for protecting primary data are Redundant Arrays if Independent Disk is known as the RAID, by making multiple and snap copies, and through CDP (continuous data protection method. The primary data protection in cloud computing is based on userchoice.

In present days the mentioned above method for data protection is not preferred due to complex situations and the cost of these methods. Cloud storage systems sometimes make multiple copies of the data within the system on the non-RAID protection storage spaceto maintain the cost at a lower level. An in-house enterprise solution must be the same as the primary data protection in the enterprise cloud. The robust techniques must be made available in BIA (business impact analysis) when they need it. Application Programming Interface closely associateswiththeapplicationsothedataprotectionisdifficultint hissituation.

3.6StorageAgility

Storage agility is the ability of the business to adapt rapid and cost efficiency in the response to the business environment. It can be attained by quickly adapting goods and services to meet the need for the demand of the consumer. Operating System Management allows the system to stay updated and stay in present, and allocating the resources among the program. The MOS is given by the cloud-based system. Custom Operating system image includes customization, andconfigurationareinstalledwhentheimagewascreated.TheO Simagesaregivenbythe customer so the cloud-based provider have no idea on this process. This is the best one when compared to all the other methods discussed in this research. Additional storage space can be included in some solution in a limited amount. The storage space can also be removed in the volume point level. The capability for the OS to accept these changes are considered as aboundedfactor.

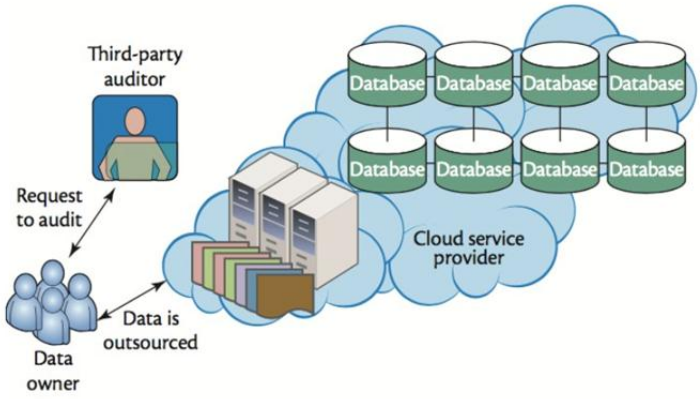

FIGURE 6 Architecture of cloud data service

3.7 Performance

The performance part in cloud-computing requires money. In a well-made system there will be a balance between cost and its performance. It can be achieved when the business enterprise is matched with the right performance needs in this case the business enterprises will change the business language to the IT language. The translation is difficult sometime so the business enterprise chooses the fixed IT structure where the better performance cannot be achieved. The cloud-computing based enterprises provides a plan which is suited along with the change in the performance needs. The storage Input/Output in cloud-based system is inactive this is due to the reason where are vendors are high focused only on making the data in the cloud-based

systemtheconsiderationofitsperformancewasnotgivenimportance.

The reasons for latency to stay at higher level: the access method and the configuration of media utilization. The access method here consists of multi-level protocols such as SOAP, Inter- net Protocol, Network File Service, etc are considered over OSI (open system interconnection) model.
Data access consist of shared and several other level of protocols have more latency than the physical layer. Most mass market clouds also include the Internet in the data access, which contributes to data accesslatency.

FIGURE 7 Cloud Storage Space Vs Performance

3.8 Scalability

Scalability must be considered not only for storage but also for considering the bandwidth to that particular storage. The most important aspect of cloud-based system storage is the geographic distribution of its data, which allows the data to be near to the user through the cloud-based data storage center. Replication and distribution are even available for read-only dataalso.

Analysis of Cloud StorageService

The cloud-based storage system allows the users to have their personal data in storage sys- tem by getting some amount of money from the users. These files stored in cloud system can be accessed at anytime, anywhere using Internet. Modification can be done by the users by downloading the files and can be uploaded in cloud system after modification. The needs of the users must be given importance in the cloud-based storage system, also in public or private cloud-basedstorage.

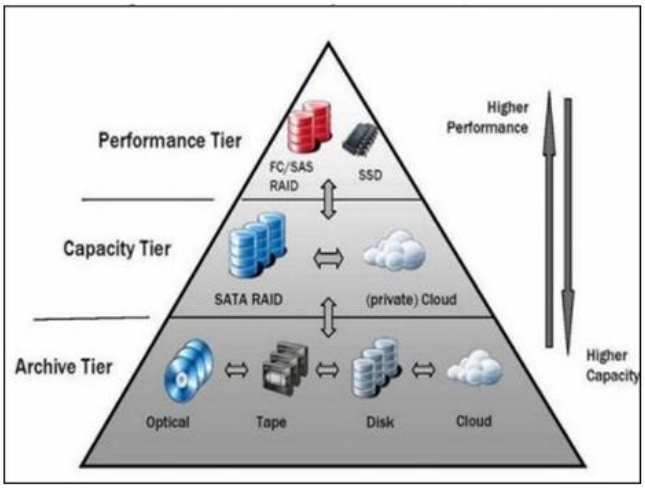

FIGURE 8 Cloud Storage variations at Layers

The cloud will be utilized for the provided data and its storage should be utilized before migrating it to the cloud-based storage device. In classic data-center do not take benefit of the cloud-based storage system.
But in the case of the private cloud storage the data set are designed to take benefit on the cloud-based storage system. The private cloud storage is utilized for data protection purpose.
In federated cloud storage the data are designed to take benefit as well as capacityare made accessible by the cloud-based storage provider. [10] considers energy consumption in storage as a service. They are considered as file storage and backup service. The files can be downloaded for viewing the file then if any changes are needed it is done and then later uploaded in the cloud. The power consumed for storage(Pst) based on user is measured as functionofdownloadsperfileperhouris

$$P_{st} = \frac{B_d D}{3600}\left(E_T + \frac{3P_{st,SR}}{2C_{st,SR}}\right) + 2B_d\frac{3P_{SD}}{2B_{SD}} \quad (1)$$

where:
• Bd (bits) is the average size of a file;
• D is the number of downloads per hour;
• Pst,SR is the power consumption of each content server;
• Cst,SR (bits per second) is the capacity of each content server;
• the power consumption of hard disk arrays (cloud storage) is PSD and their capacity is BSD (bits).
The disadvantage of this model is that an assumption was developed that the files which are accessed regularly acquires energy when it is stored, but in the case of cloud-based system with million users it is difficult to know which files are processed, and to store them in the small disk.

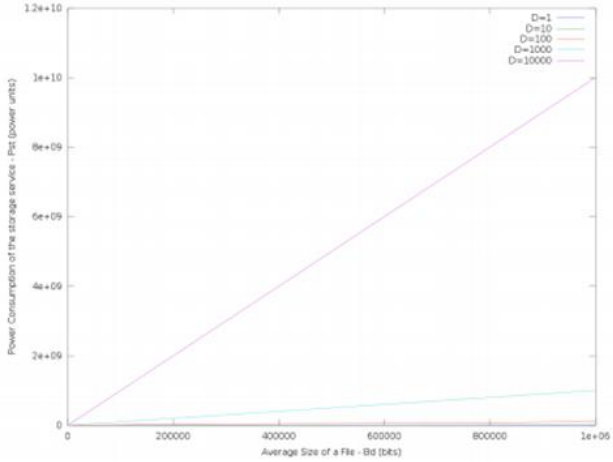

Figure 9 Energy consumption of storage as a service (for different download rates).

Fig 9 illustrates the 1st equation considering various download rate. The increases with increase in download rate.

$$\Delta P_{st} = \frac{P_{st}}{D}\Delta D. \quad (2)$$

Where Pst,SR Cst,SR, and Pst of hard disk array are the same. It is found that power con- sumption can be controlled if the behaviour of the user is controlled which helps in the predic- tion of downloadrate.

Energy-Aware Key Issues andChallenges

[34-38] The data center structure for energy awareness storage should consider the follow- ing:
The scalability factor The flexibility factor Same storage capacity
Free virtual machine migration Backward compatibility factor.
[35] New challenge always rise in service, VM migration, managing energy, traffic manage- ment, providing data security, framework for software, storage, management of data in Big-Data, and Novel cloud structure etc.
[37]
Thededicatedservershouldbeutilized,wheretheidlepowercostisefficientlypaid.
[38] The main challenge in energy aware storage system is degradation in the performance and variation inpower.
[39-43] Some of the challenges are considered as management of architecture, efficiency, re- sponse to time, software development methods, collaboration between the one who is providing the service and the user should be addressed.
[40] Google File System developed by Google to give large quantity of data and accessability through a group of community hardware.
[44-48] The Hadoop Distributed File System developed by Hadoop for handling large data running in the community hardware.
[48-52] Green-HDFS developed by Hadoop which organises the data in cloud data center in multiple cloud zones.
The cloud storage providers should be compared based on the certain condition like price, value for money, capacity for storage, the speed for uploading and downloading the file, relia- bility, and support.
Another aspect in this platform is the Personal computer compatibility, access to mobile, supporting the android apps. In the view point of cloud-based provider Amazon, Windows Azure,andGoogleAppenginesarethemostrepresentativeproducts.

Conclusion

The main concept cloud-based computing system are based on Platform as Service, and In- frastructure as a Service, and on cloud-application and its platform. The primary challenge in the management of cloud-based system are in providing middle ware ability for building, inte- gration and management of application in multiple tenant, elastic and scalability environment. These challenges are relevant for cloud-based storage system on energy-aware concept. This research paper tried to focus on cloud-based storage system and computing the cost of user. In the analysis the key challenges in the system are found. The important challenge in developing cloud-based application is based on the scalability, agility,and reliability of the cloud system. The further research based on this concept will be related to profile of the user and application contenttodevelopadependentandgreencloud-basedstoragesystem.

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Author Profile

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