A Detailed Literature Review on Cloud Computing

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Abstract – **Cloud computing is an architecture for facilitating computing service through the internet on requirement and pay per use access to a group of shared resources namely networks, storage, servers, services and applications, without physically acquiring them Cloud DBMS is a distributed database that gives computing as a service. It is sharing of web infrastructure for resources, software and information over a network. The cloud is used as a storage location and database can be accessed and computed from anywhere. In this paper I have discussed about cloud and its use. How we can implement cloud for better performance and different benefits and drawbacks of cloud which we can improve in future**

Keywords: **Introduction, Cloud Computing, Database, Cloud Database, Database Management System, Cloud Architecture**

I. INTRODUCTION

Web-based network management revolving about database puts forward a feasible mode for network information processing and has the characteristics of wide distribution, full interactivity, real-time dynamic and so on in the application; and is beneficial to timely adjustment for network performance and rapid recovery for fault. For this purpose cloud database management system plays very important role. Cloud Computing is a general term used to describe a new class of network based computing that takes place over the Internet. Cloud Computing is basically a step on from Utility Computing. It is collection/group of integrated and networked hardware, software and Internet infrastructure (called a platform), Using the Internet for communication and transport provides hardware, software and networking services to clients. The benefit of this is that these platforms hide the complexity and details of the underlying infrastructure from users and applications by providing very simple graphical interface or API (Applications Programming Interface). The cloud is used as a storage location and database can be accessed and computed from anywhere. The large number of web application makes the use of distributed storage solution in order to scale up.

There are some important definitions on Cloud computing:

S. No	Definition	Author
1.	Cloud computing is a model for enabling convenient, on-demand network access 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.	**National Institute of Standards and Technology (NIST)**
2.	"Cloud computing really comes into focus only when you think about what IT always needs: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends its existing capabilities."	**Bill Martin**
3.	"I view cloud computing as a broad array of web-based services aimed at allowing users to obtain a wide range of functional capabilities on a 'pay-as-you-go' basis that previously required tremendous hardware/software investments and professional skills to acquire. Cloud computing is the realization of the earlier ideals of utility computing without the technical complexities or complicated deployment worries."	**Ben Kepes**
4.	"When virtualizing applications to be used by people who care	

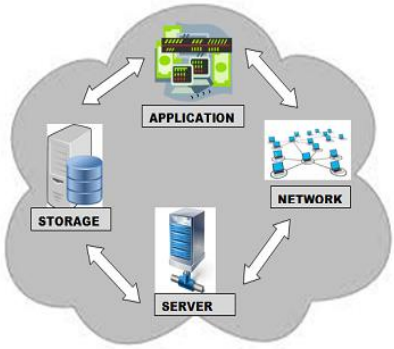
	nothing about computers or technology - as is mostly the case with Clouds - the key thing we want to virtualize or hide from the user is complexity. Most people want to deal with an application or a service, not software. ... The more intelligent we want [computers and computer applications] to be - that is, intuitive, exhibiting common sense and not making us have to constantly take care of them - the more smart software it will take. But with cloud computing, our expectation is that all that software will be virtualized or hidden from us and taken care of by systems and/or professionals that are somewhere else - out there in The Cloud."	**Irving Wladawsky Berger**
5.	"Today's combination of high-speed networks, sophisticated PC graphics processors, and fast, inexpensive servers and disk storage has tilted engineers toward housing more computing in data centers. In the earlier part of this decade, researchers espoused a similar, centralized approach called "grid computing." But cloud computing projects are more powerful and crash-proof than grid systems developed even in recent years."	**Aaron Ricadela**
6.	"The web fanatics and blogosphere would have you believe that all applications will move to the web. Some will, most will not. Reliability, scalability, security, and a host of other issues will prevent most businesses from moving their mission critical applications to hosted services or cloud based services. The risk of failure is too great. Amazon is the leader in cloud based services, but even Amazon has experienced down times for its own business. Cloud services will continue to improve. But my guess is the uptake will take longer than most people predict."	**Don Dodge**
7.	"Most computer savvy folks actually have a pretty good idea of what the term "cloud computing" means: outsourced, pay-as-you-go, on-demand, somewhere in the Internet, etc."	**Thorsten Von Eicken**
8.	"In order to discuss some of the issues surrounding The Cloud concept, I think it is important to place it in historical context. Looking at the Cloud's forerunners, and the problems they encountered, gives us the reference points to guide us through the challenges it needs to overcome before it is adopted."	**Paul Wallis**
9.	"I view cloud computing as a broad array of web-based services aimed at allowing users to obtain a wide range of functional capabilities on a 'pay-as-you-go' basis that previously required tremendous hardware/software investments and professional skills to acquire. Cloud computing is the realization of the earlier ideals of utility computing without the technical complexities or complicated deployment worries."	**Jeff Kaplan**
10.	"Cloud computing overlaps some of the concepts of distributed, grid and utility computing, however it does have its own meaning if contextually used correctly. Cloud computing really is accessing resources and services needed to perform functions with dynamically changing needs. An application or service developer requests access from the cloud rather than a specific endpoint or named resource. What goes on in the cloud manages multiple	**Kevin Hartig**

	infrastructures across multiple organizations and consists of one or more frameworks overlaid on top of the infrastructures tying them together. The cloud is a virtualization of resources that maintains and manages itself."	
11.	"The 'cloud' model initially has focused on making the hardware layer consumable as on-demand compute and storage capacity. This is an important first step, but for companies to harness the power of the cloud, complete application infrastructure needs to be easily configured, deployed, dynamically-scaled and managed in these virtualized hardware environments."	**Kirill Sheynkman**
12.	"SaaS is one consumer facing usage of cloud computing. While it's something of a semantic discussion it is important for people inside to have an understanding of what it all means. Put simply cloud computing is the infrastructural paradigm shift that enables the ascension of SaaS."	**Ben Kepes**
13.	"There sure is a lot of confusion when it comes to talking about cloud computing. Yet, it does not need to be so complicated. There really are only three types of services that are cloud based: SaaS, PaaS, and Cloud Computing Platforms. I am not sure being massively scalable is a requirement to fit into any one category."	**Brian de Haaff**
14.	"People are coming to grips with Virtualization and how it reshapes IT, creates service and software based models, and in many ways changes a lot of the physical layer we are used to. Clouds will be the next transformation over the next several years, building off of the software models that virtualization enabled."	**Douglas Gourlay**
15.	"The "Cloud" concept is finally wrapping peoples' minds around what is possible when you leverage web-scale infrastructure (application and physical) in an on-demand way. "Managed Services", "ASP", "Grid Computing", "Software as a Service", "Platform as a Service", "Anything as a Service"… all terms that couldn't get it done. Call it a "Cloud" and everyone goes bonkers. Go figure."	**Damon Edwards**
16.	"For me the simplest explanation for cloud computing is describing it as, 'internet centric software.' This new cloud computing software model is a shift from the traditional single tenant approach to software development to that of a scalable, multi-tenant, multi-platform, multi-network, and global. This could be as simple as your web based email service or as complex as a globally distributed load balanced content delivery environment. I think drawing a distinction on whether its, PaaS, SaaS, HaaS is completely secondary, ultimately all these approaches are attempting to solve the same problems (scale). As software transitions from a traditional desktop deployment model to that of a network & data centric one, "the cloud" will be the key way in which you develop, deploy and manage applications in this new computing paradigm."	**Reuven Cohen**
17.	"What is cloud computing all about? Amazon has coined the word "elasticity" which gives a good idea about the key features: you can scale your infrastructure on demand within minutes or even seconds, instead of days or weeks, thereby avoiding under-utilization (idle servers) and over-utilization (blue screen) of in-	**Markus Klems**

	house resources. With monitoring and increasing automation of resource provisioning us might one day wake up in a world where we don't have to care about scaling our Web applications because they can do it alone."	
18.	"The way I understand it, "cloud computing" refers to the bigger picture…basically the broad concept of using the internet to allow people to access technology-enabled services. According to Gartner, those services must be 'massively scalable' to qualify as true 'cloud computing'. So according to that definition, every time I log into Facebook, or search for flights online, I am taking advantage of cloud computing."	**Praising Gaw**

II. CLOUD COMPUTING

A key differentiating element of a flourishing information technology (IT) is its ability to become a factual, precious, and economical contributor to cyberinfrastructure. Cloud computing is basically a general term used to refer to a class of network based computing where a program or application runs on a connected server or servers rather than on a local computing device such as a PC, tablet or Smartphone. Cloud Computing is a distributed architecture that centralizes server resources on a scalable platform so as to provide on demand computing resources and services [1].



It is a shared Pool of configuration computing. Cloud Computing provides on demand services to the users. Basically clouds are transparent to the users and the applications means there is no hurdle or obstacle in using cloud from both sides. Like a tradition client-server network model the client connects with the server to get the data. The basic difference in cloud is that it can run concurrently or supply data to more than one users at the same time utilizing the concept of Virtualization. Virtualization means an abstraction of an execution environment that can be made dynamically available to authorized clients by using well-defined protocols, Resource quota (e.g. CPU, memory share), Software configuration (e.g. O/S, provided services). The computing resources have become "granular", which provides end user and operator benefits including on-demand self-service, broad access across multiple devices, resource pooling, rapid elasticity and service metering capability [3].

The strategy behind the technology:

A cohesive cloud strategy that drives successful business outcomes relies on collaboration between IT staff and executives. Just as IT cannot act as a silo within the business, cloud computing cannot function as a silo within IT. Other cloud providers' proprietary technologies require that you adjust your IT environment to their capabilities. A long-term strategy demands an infrastructure that is open and can adapt as your business and IT priorities change. Dell's approach to designing and implementing an open cloud strategy focuses on business and cultural expectations.

1. **Cloud computing is not a technology, it's a strategy.** Cloud computing is part of an overall strategy to accelerate growth, empower your workforce and transform your business. We are committed to developing solutions that match your business vision and that drive it forward with maximum flexibility and minimum risk.
2. **Cloud computing should adapt to you, not you to it.** Most businesses are already on the cloud journey, but each has unique needs and obstacles. We work with you and your staff to match your strategy to the right cloud solutions — without disrupting your business.
3. **Cloud computing works best when it integrates seamlessly.** Our approach is not to rip and replace, but rather to make use of existing investments and build from the current state. We see cloud computing as a logical progression to what organizations are already doing, and a way for businesses to build on technologies and processes already in place.

Key features of Cloud Computing:

1. **On-demand self-service** - user can control computing capabilities without human interaction from the service's provider.
2. **Omnipresent network access** - access is promoted through the use of several different technology devices

3. **Location independent resource pooling** - the provider's computing resources are pooled to serve all customers with different resources assigned according to the user's demand
4. **Rapid elasticity** - capabilities available for rent can be quickly scaled up or down so that the end user can purchase any amount at any time
5. **Pay per use** - examples are measuring the storage, bandwidth, and computing resources consumed and then charging for the number of active user accounts per month

III. DATABASE

A database is an organized collection of data. The data are typically organized to model relevant aspects of reality in a way that supports processes requiring this information. For example, modelling the availability of rooms in hotels in a way that supports finding a hotel with vacancies.

A database-management system (DBMS) is a collection of interrelated data and a set of programs to access those data. The collection of data, usually referred to as the database, contains information relevant to an enterprise. The primary goal of a DBMS is to provide a way to store and retrieve database information that is both convenient and efficient. Well-known DBMS include MySQL, MariaDB, PostgreSQL, SQLite, Microsoft SQL Server, Microsoft Access, Oracle, SAP HANA, and dBASE, FoxPro, IBM DB2, Libre Office Base, File Maker Pro and Inter Systems Cache.

Database systems are designed to manage large bodies of information. Management of data involves both defining structures for storage of information and providing mechanisms for the manipulation of information. In addition, the database system must ensure the safety of the information stored, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results. Because information is so important in most organizations, computer scientists have developed a large body of concepts and techniques for managing data.

Applications of Database Systems:
Databases are widely used. Here are some representative applications:

1. **Banking:** For customer information, accounts, and loans, and banking transactions.
2. **Airlines:** For reservations and schedule information. Airlines were among the first to use databases in a geographically distributed manner—terminals situated around the world accessed the central database system through phone lines and other data networks.
3. **Universities:** For student information, course registrations, and grades.
4. **Credit card transactions:** For purchases on credit cards and generation of monthly statements.
5. **Telecommunication:** For keeping records of calls made, generating monthly bills, maintaining balances on prepaid calling cards, and storing information about the communication networks.
6. **Finance:** For storing information about holdings, sales, and purchases of financial instruments such as stocks and bonds.
7. **Sales:** For customer, product, and purchase information.
8. **Manufacturing:** For management of supply chain and for tracking production of items in factories, inventories of items in warehouses/stores, and orders for items.
9. **Human resources:** For information about employees, Salaries, payroll taxes and benefits, and for generation of pay checks.

As the list illustrates, databases form an essential part of almost all enterprises today over the course of the last four decades of the twentieth century, use of databases grew in all enterprises. In the early days, very few people interacted directly with database systems, although without realizing it they interacted with databases indirectly— through printed reports such as credit card statements, or through agents such as bank tellers and airline reservation agents. Then automated teller machines came along and let users interact directly with databases. Phone interfaces to computers (interactive voice response systems) also allowed users to deal directly with databases—a caller could dial a number, and press phone keys to enter information or to select alternative options, to find flight arrival/departure times, for example, or to register for courses in a university. The internet revolution of the late 1990s sharply increased direct user access to databases. Organizations converted many of their phone interfaces to databases into Web interfaces, and made a variety of services and information available online. For instance, when we access an online bookstore and browse a book or music collection, you are accessing data stored in a database. When you enter an order online, your order is stored in a database. When you access a bank Web site and retrieve your bank balance and transaction information, the information is retrieved from the bank's database system. When you access a Web site, information about you may be retrieved from a database, to select which advertisements should be shown to you.

IV. FEATURES OF DATABASE

1. **Self-describing nature of a DBMS:** Database System contains the database itself as well as the descriptions of data structure and constraints (meta-data).
2. **Support multiple views of data:** View is a subset of the database which is defined and dedicated for

particular users of the system. The Multiple users in the system might have different views of the system.

3. **Data sharing:** In data sharing the integration of the whole data in an organization has the ability to produce more information from a given amount of data.
4. **Data independence:** System data are separated from the application programs and changes to the data structure are handled by the DBMS and not embedded in the program.
5. **DBMS provides backup as well as recovery facilities:** If the computer system fails in the complex update process, the recovery subsystem is restored to the stage it was in before the process started executing.
6. **Restricting unauthorized access:** The DBMSs should provide a security subsystem to create and control the user accounts. The examples of database applications are: computerized library systems, automated teller machines, flight reservation systems, computerized parts inventory systems.

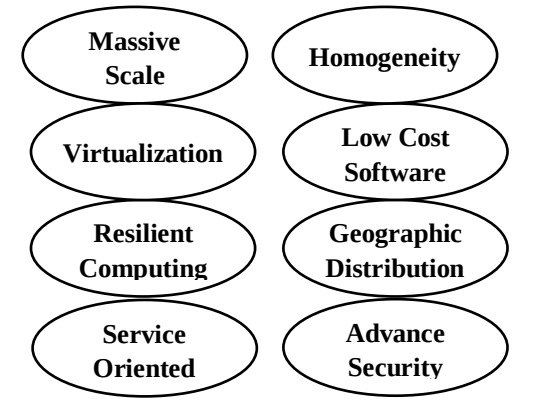
V. CLOUD DATABASE

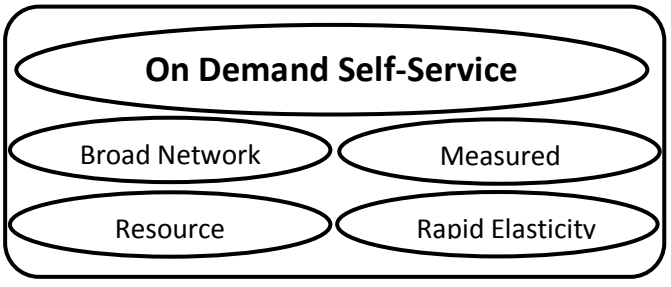
A cloud database is a type of database service that is built, deployed and delivered through a cloud platform. It is primarily a cloud Platform as a Service (PaaS) delivery model that allows organizations, end users and their applications to store, manage and retrieve data from the cloud. A cloud database typically works as a standard database solution that is generally implemented through the installation of database software on top of a computing/infrastructure cloud. It may be directly accessed through a Web browser or a vendor provided API for application and service integration. Unlike a typical database, a cloud database may be scaled on run-time, in which additional instances and resources of storage and computing may be assigned instantly. Moreover, a cloud database is also delivered as a service, where the vendor directly manages the backend processes of database installation, deployment and resource assignment tasks.

VI. CLOUD CHARACTERISTICS

Cloud computing is a sharing of resources to achieve coherence and economies of scale, similar to a utility over a network. The cloud service also focuses on maximizing the effectiveness of the shared resources. The cloud resources are usually shared by multiple users as well as dynamically reallocated per demand. The cloud characteristics are [4]:

1. **On-demand self-service:** A consumer can gain computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
2. **Measured service:** The cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service. The resource usage are managed, controlled and reported, providing transparency for both the provider and consumer of the utilized service.[5]
3. **Resource pooling capability:** The computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and then reassigned according to consumer demand.
4. **Broad network access:** The capabilities are available over the network and are accessed through standard mechanisms that promote used by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs).
5. **Rapid elasticity:** The cloud is flexible and scalable to suit our immediate business needs.





Implementation Model:

There are two primary methods to run a database on the cloud:

1. **Virtual machine Image** - cloud platforms allow users to purchase virtual machine instances for a limited time. It is possible to run a database on these virtual machines. Users can either upload their own machine image with a database installed on it, or use ready-made machine images that already include an optimized installation of a database. For example, Oracle provides a ready-made machine image with an installation of Oracle Database 11g Enterprise Edition on Amazon EC2.
2. **Database as a service** (DBaaS) - some cloud platforms offer options for using a database as a service, without physically launching a virtual machine instance for the database. In this configuration, application owners do not have to install and maintain the database on their own. Instead, the database service provider takes responsibility for installing and maintaining the database, and application owners pay according to their usage. For example, Amazon Web Services provides three database services as part of its cloud offering, SimpleDB, a NoSQL key-value store, Amazon Relational Database Service, an SQL-based database service with a MySQL interface, and DynamoDB

VII. ARCHITECTURE OF CLOUD DATABASE

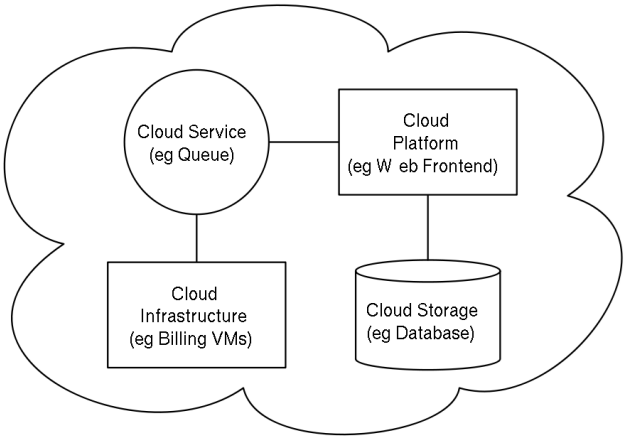
a) Involves multiple components communicating with each other over application programming interfaces, usually web services and 3-tier architecture.

b) Multiple programs each doing one thing well and working together over universal interfaces.

c) Complexity is controlled and the resulting systems are more manageable than their monolithic counterparts.

The two most significant components of cloud computing architecture are known as the front end and the back end.

- The front end is the part seen by the client, i.e. the computer user. This includes the client's network and applications used to access the cloud via a user interface such as a web browser.
- The back end of the cloud computing architecture is the 'cloud' itself, comprising various computers, servers and data storage devices.



Different Ways to run Database on Cloud:

1. Public cloud
2. Community cloud
3. Hybrid cloud and hybrid IT delivery
4. Combined cloud
5. Private cloud

VIII. ADVANTAGES OF CLOUD DATABASE

1. Lower computer costs:
   a) We do not need a high-powered and high-priced computer to run cloud computing's web-based applications.
   b) Since applications run in the cloud, not on the desktop PC, our desktop PC does not need the processing power or hard disk space demanded by traditional desktop software.
   c) When we are using web-based applications, our PC can be less expensive, with a smaller hard disk, less memory, more efficient processor...
   d) In fact, our PC in this scenario does not even need a CD or DVD drive, as no software programs have to be loaded and no document files need to be saved.
2. Improved performance:
   a) With few large programs hogging your computer's memory, we will see better performance from your PC.
   b) Computers in a cloud computing system boot and run faster because they have fewer programs and processes loaded into memory.
3. Reduced software costs:
   a) Instead of purchasing expensive software applications, we can get most

of what we need for free. Most cloud computing applications today, such as the Google Docs suite.

b) Better than paying for similar commercial software which alone may be justification for switching to cloud applications.

4. Instant software updates:
   a) Another advantage to cloud computing is that we are no longer faced with choosing between obsolete software and high upgrade costs.
   b) When the application is web-based, updates happen automatically available the next time we log into the cloud.
   c) When we access a web-based application, we get the latest version without needing to pay for or download an upgrade.
5. Improved document format compatibility.
   a) we do not have to worry about the documents we create on our machine being compatible with other users' applications or OSS
   b) There are potentially no format incompatibilities when everyone is sharing documents and applications in the cloud.
6. Unlimited storage capacity:
   a) Cloud computing offers virtually limitless storage.
   b) Our computer's current 1 Tbyte hard drive is small compared to the hundreds of Pbytes available in the cloud.
7. Increased data reliability:
   Unlike desktop computing, in which if a hard disk crashes and destroy all your valuable data, a computer crashing in the cloud should not affect the storage of your data. If our personal computer crashes, all our data is still out there in the cloud, still accessible
8. Universal document access:
   a. That is not a problem with cloud computing, because we do not take our documents with us. Instead, they stay in the cloud, and we can access them whenever we have a computer and an Internet connection
   b. Documents are instantly available from wherever we are
9. Latest version availability:
   1. When we edit a document at home, that edited version is what we see when you we access the document at work.
   2. The cloud always hosts the latest version of your documents as long as we are connected, we are not in danger of having an outdated version
10. Easier group collaboration:
    a. Sharing documents leads directly to better collaboration.
    b. Many users do this as it is an important advantages of cloud computing
    c. multiple users can collaborate easily on documents and projects
11. Device independence.
    1. We are no longer tethered to a single computer or network.
    2. Changes to computers, applications and documents follow we through the cloud.

    Move to a portable device, and our applications and documents are still available.

IX. DISADVANTAGES OF CLOUD DATABASE

1. Requires a constant Internet connection:
   a. Cloud computing is impossible if you cannot connect to the Internet.
   b. Since we use the Internet to connect to both your applications and documents, if we do not have an Internet connection we cannot access anything, even our own documents.
   c. A dead Internet connection means no work and in areas where Internet connections are few or inherently unreliable, this could be a deal-breaker.

2. Does not work well with low-speed connections:
   a. Similarly, a low-speed Internet connection, such as that found with dial-up services, makes cloud computing painful at best and often impossible.
   b. Web-based applications require a lot of bandwidth to download, as do large documents.

3. Features might be limited

This situation is bound to change, but today many web-based applications simply are not as full-featured as their desktop-based applications. For example, you can do a lot more with Microsoft PowerPoint than with Google Presentation's web-based offering

4. Can be slow:
    a. Even with a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC.
    b. Everything about the program, from the interface to the current document, has to be sent back and forth from our computer to the computers in the cloud.
    c. If the cloud servers happen to be backed up at that moment, or if the Internet is having a slow day, you would not get the instantaneous access you might expect from desktop applications.
5. Stored data might not be secure:
    a. With cloud computing, all our data is stored on the cloud. The questions is How secure is the cloud?
    b. Can unauthorized users gain access to your confidential data?
6. Stored data can be lost:

    Theoretically, data stored in the cloud is safe, replicated across multiple machines. But on the off chance that our data goes missing, we have no physical or local backup. Put simply, relying on the cloud puts us at risk if the cloud lets us down.

X. CONCLUSION

In this paper I have discussed various opinions of different writers about Cloud and Cloud Computing. I have done a literature review on cloud computing, Cloud database, how cloud can be implement. I have found that although the cloud computing is a very emerging technique and it has various benefits also it we are using cloud but still it has some disadvantages also which we need to improve in future because if we will be able to minimize the disadvantages it will be the best technique for all of us in the future.

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