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Database Management as a Service in Cloud

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Abstract:- In recent years, database outsourcing has become an important component of cloud computing. Due to the Rapid advancements in a network technology, the cost of transmitting a terabyte of data over long distances as decreased significantly in the past decade. In addition, the total cost of data management is five to ten Times higher than the initial acquisition cost. As a result, there is a growing interest in outsourcing database management tasks to third parties that can provide these tasks for much lower cost due to the economy of Scale. This new outsourcing model has the benefits of reducing the cost for running Database Management System (DBMS) independently.

Keyword: RDBMS, Big Data, DBMS.

1. Introduction

A Cloud database management system is a distributed database that delivers computing as a service instead of a product. It is the sharing of resources, software, and information between multiple devices over a network which is mostly the internet. It is expected that this number will grow significantly in the future. As a result, there is a growing interest in outsourcing database management tasks to third parties that can provide these tasks for much lower cost due to the economy of scale just like putting it into the cloud. In this paper, we discuss the recent trend in database management system and the possibilities of making it as one of the services offered in the cloud.

Storing of data on computer hard disk and secondary storage is too main stream and has been facing many problems these days, due to data loss, failure and difficulty in remote access by concurrent users. To avoid data loss and allow concurrent users access, Cloud Computing has been put into use which allows data to be stored on a virtual cloud like storage area, which can be accessed by a user from remote location and data is even safe. Using Database as a Cloud Service allows the user to access the data stored on an online database (present on a cloud) and is hence proving to be an efficient technological advancement these days.

Most DBMS or database management systems are simply software packages that users can acquire to create, maintain or use a database. However, since the introduction of cloud computing, DBMS has morphed into an entirely new type of service with its own unique benefits and task specific advantages. For one thing, any type of cloud service model will have to employ a dedicated cloud DBMS in order to truly provide customers with excellent access to data and databases. Traditional DBMS's are simply not set up or equipped to deal with the demands of cloud computing. And of course, if DBMS was deployed as a service as part of a larger package provided, it would likely be much more efficient in its duties and therefore cheaper in the long run. The concept of the DBMS has been around since the beginning of commercial computing; such as the navigational DBMS of the1960's. Database management systems are one of the oldest integral components of computing, essentially making it possible to scan, retrieve and organize data on hard drives and networks.

All DBMS, despite whether traditional or cloud-based, are essentially communicators that function as middlemen between the operating system and the database. How is a cloud DBMS different a traditional one? For one thing, cloud-based DBMS are extremely scalable. They are able to handle volumes of data and processes that would exhaust a typical DBMS. Despite their scalability however, cloud DBMS are still somewhat lacking in their ability to scale up to extremely large processes; this is expected to be remedied in the coming months and years however. Currently, the use of cloud DBMS's are principally used in the testing and development of new cloud applications and processes. But while a stand-alone DBMS can be used on a cloud infrastructure; most are not designed to take full advantage of cloud resources. DBMS as a cloud service type models seek to capitalize on the disparity between antiquated DBMS models and their lack of full cloud functionality.

2. Cloud Database Strategy

One of the most significant (and complex) cloud infrastructure issues facing cloud providers of many types is deciding how database support will be offered in the cloud, which is also leading to selling Database as a Service. The wrong cloud database strategy can create application performance problems significant enough to discredit a cloud service, forcing the provider to incur additional costs to establish credibility with users. The cloud database issue is complicated because it sits at the intersection of two cloud infrastructure models, two storage service models and two database management systems (DBMS) models. Sorting out the details will require cloud to consider their infrastructure, network performance and service goals.

The following services models can affect cloud database support:

1) Single and multi-site cloud infrastructure models: The two cloud infrastructure models differ in the way that resources are allocated to customers. In the single site model, a customer's applications run within a single data centre in the cloud, even if multiple data centers are available. This means that the storage and/or DBMS resources used by a customer can be contained within a single storage area network (SAN), and that the customer's application performance in the cloud can likely match that of a standard data centre that uses virtualization. In the multi-site model, the customer's applications can draw on resources from multiple data centre's, which mean that making the connection between the application and the database resources could involve WAN connectivity that limits performance. Whichever choice they make, service providers must be ready to address the issues that come with single- or multi-site cloud infrastructure.

2) Storage and database service models: The storage service models available to a cloud planner are Storage as a Service or the more complex Database as a Service. With storage services, the customer will access virtual storage devices as though they were native disk arrays, which means that the applications will send storage protocols (such as Fibre Channel over Ethernet or IP SCSI) over any network connection. In the relatively new Database as Service offerings, applications will access storage through a cloud DBMS that will accept high-level database commands and return the required results. This can create a less delay-sensitive connection, so it is better suited to cloud configurations where storage might be distributed over multiple sites.

Another major cloud database planning decision is whether a cloud database service should be based on the popular relational database management system (RDBMS) and its Structured Query Language (SQL) standards, based on a lighter-weight RDBMS without SQL, or based on a non-relational structure like the 'Google Big Table' structure that gives users dynamic control over data layout and format.

Above is a proposed DBMS in Cloud Architecture, first layer is the storage, followed by databases and the upper layer is application layer. In terms of performance, it provides efficient data access with a better distribution of values for some data. Stores frequently used SQL statements in memory, avoiding the need for time consuming recompilation at run-time. Produces a detailed report on each step used for data access, allowing you to accurately implement performance enhancements. Data is encrypted when stored or backed up, without any need for programming to encrypt and decrypt.

3. The Value Of DBMS-As-A-Cloud Service

1) Database as a Service has advantages beyond marketing. With a cloud DBMS, storage virtualization isn't directly visible to the applications, which gives operators more latitude in how they manage storage resources.

2) With a direct storage model, a mechanism for storage virtualization that protects customers' data from being accessed by others but still makes the virtual disks look "real" is essential

3) It helps in controlling the performance of applications that use storage extensively

4) It's easy to provide cloud database services as part of a cloud Platform as a Service (PaaS) offering, but the applications may have to be written to access cloud database services in some Infrastructure as a Service (IaaS) configurations.

5) Offering Database as a Service can help by replacing storage input/output (I/O) with simply sending a query and a return of results.

4. Some Challenges to DM-as-a-Service(DMaas) in Cloud

The key ingredients to this success are due to many features DBMSs offer: overall functionality, consistency, performance, and reliability. In spite of this success, during the past decade Database Scalability, Elasticity, Availability and Autonomy in the Cloud there has been a growing concern that DBMSs and RDBMSs are not cloud-friendly. This is because, unlike other technology components for cloud service such as the web servers and application servers, which can easily scale from a few machines to hundreds or even thousands of machines, DBMSs cannot be scaled very easily. There are three challenges that drive the design of Relational Cloud: efficient multi-tenancy to minimize the hardware footprint required for a given (or predicted) workload, elastic scale-out to handle growing workloads, and database privacy. In fact, past DBMS technology fails to provide adequate tools and guidance if an existing database deployment needs to scale-out from a few machines to a large number of machines. Cloud computing and the notion of large-scale data-centers will become a pervasive technology in the coming years. There are some technology hurdles that we confront in deploying applications on cloud computing infrastructures: DBMS scalability and DBMS security. In this paper, we will focus on the problem of making DBMS technology cloud friendly. In fact, we will argue that the success of cloud computing is critically contingent on making DBMSs scalable, elastic, available, secure and autonomic, which is in addition to the other well-known properties of database management technologies like high-level functionality, consistency, performance, and reliability.

Database Scalability in the Cloud:-

Scalability is a desirable property of a system, which indicates its ability to either handle growing amounts of work in a graceful manner or its ability to improve throughput when additional resources (typically hardware) are added. In the context of cloud-computing paradigms notion of scalability, there are two options for scaling the data management layer. The requirement of making web-based applications scalable in cloud computing platforms arises primarily to support virtually unlimited number of end-users. Another challenge in the cloud that is closely tied to the issue of scalability is to develop mechanism to respond to sudden load fluctuations on an application or a service due to demand surges or troughs from the end-users. Scalability of a system only provides us a guarantee that a system can be scaled up from a few machines to a larger number of machines. In cloud computing environments, we need to support additional property that such scalability can be provisioned dynamically without causing any interruption in the service. The first option is to start with key-value stores, which have almost limitless scalability, and explore ways in which such systems can be enriched to provide higher-level database functionality especially when it comes to providing transactional access to multiple data and informational entities. The other option is to start with a conventional DBMS architecture and leverage from key-value store architectural design features to make the DBMS highly scalable.

Database Elasticity in the Cloud:-

This type of dynamic provisioning where a system can be scaled-up dynamically by adding more nodes or can be scaled-down by removing nodes is referred to as elasticity. One of the major factors for the success of the cloud as an IT infrastructure is its pay-per-use pricing model and elasticity. For a DBMS deployed on a pay per-use cloud infrastructure, an added goal is to optimize the system's operating cost. Elasticity, i.e. the ability to deal with load variations by adding more resources during high load or consolidating the tenants to fewer nodes when the load decreases, all in a live system without service disruption, is therefore critical for these systems. Even though elasticity is often associated with the scale of the system, but Scalability is a static property of the system that specifies its behavior on a static configuration. Elasticity is a desirable and important property of large scale systems. For a system deployed on a pay-per-use cloud service, such as the Infrastructure as a Service (IaaS) abstraction, elasticity is critical to minimize operating cost while ensuring good performance during high loads. It allows consolidation of the system to consume less resources and thus minimize the operating cost during periods of low load while allowing it to dynamically scale up its size as the load decreases. One must also consider the impact of powering down on availability. For instance, consolidating the system to a set of servers all within a single point of failure as in a switch or a power supply unit. That can result in an entire service outage resulting from a single failure.

Availability:-

It is not necessary that all services require the same level of availability which is why DBaaS service definitions include quality of service characteristics. Specifying what levels of availability are needed will enable the provisioning, monitoring and management processes to ensure that instances are deployed on the right platforms and in the correct configuration. The delivery of high availability database services developed with the Exadata Database Machine and the Oracle Database12c software can be achieved through a variety of deployment options utilizing existing and long tested best practices.

Privacy :-

Cloud computing poses privacy concerns because the service provider can access the data that is on the cloud at any time. It could accidentally or deliberately alter or even delete information. Many cloud providers can share information with third parties if necessary for purposes of law and order even without a warrant. That is permitted in their privacy policies which users have to agree to before they start using cloud services. Solutions to privacy include policy and legislation as well as end users' choices for how data is stored. Users can encrypt data that is processed or stored within the cloud to prevent unauthorized access. A significant barrier to deploying databases in the cloud is the perceived lack of privacy, which in turn reduces the degree of trust users are willing to place in the system. If clients were to encrypt all the data stored in the DBaaS, then the privacy concerns would largely be eliminated. In Relational Cloud, one technique is developed i.e. CryptDB, a set of techniques designed to provide privacy. Database administrators can continue to manage and tune the databases, and users are guaranteed data privacy. The key notion is that of adjustable security: CryptDB employs different encryption levels for different types of data, based on the types of queries that users run. Queries are evaluated on the encrypted data, and sent back to the client for final decryption; no query processing runs on the client.

5. Conclusions

Database Management Systems as a cloud service are engineered to run as a scalable, elastic service available on a cloud infrastructure. Cloud DBMSs will have an impact for vendors desiring a less expensive platform for development. In this paper, we presented the idea of DBMS in the cloud, the possibilities to be offered as one of the services offered by promising capability of cloud computing, that is to be a DBMS as a Service. In this paper we proposed architecture of DBMS in the cloud.

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