Database Management System as a Cloud Computing Service

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ABSTRACT:
A database management system in cloud is nothing but a distributed database management system that delivere computing as a service instead of a product. A cloud computing system with database management system is the allocation of required resources, software and information between different devices over a network which is basically on the internet.
A database management system as a service (DBaaS) promises to move much of the operational burden of provisioning, configuration, scaling, performance tuning, backup, privacy, and access control from the database users to the service operator, offering lower overall costs to users. Early DBaaS efforts include Amazon RDS and Microsoft SQL Azure, which are promising in terms of establishing the market need for such a service, but which do not address three important challenges: efficient multi-tenancy, elastic scalability and database privacy. We argue that these three challenges must be overcome before outsourcing database software and management becomes attractive to many users and cost-effective for service providers. 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. It enables user to outsource the resource and services to the third party server. In this paper, We discuss the recent trend in cloud service based on database management system and offering it as one of the services in cloud.

INTRODUCTION:
Cloud computing is a construct that allows you to access applications that actually reside at a location other than your computer or other Internet-connected device; most often, this will be a distant datacenter. The beauty of cloud computing is that another company hosts your application (or suite of applications, for that matter). This means that they handle the costs of servers, they manage the software updates, and—depending on how you craft your contract—you pay less for the service. Cloud computing promises to cut operational and capital costs and, more importantly, let IT departments focus on strategic projects instead of keeping the datacenter running. You are not required to pay for hardware and maintenance.
The service provider pays for equipment and maintenance. Relational database management systems (DBMSs) are an integral and indispensable component in most computing environments today, and their importance is unlikely to diminish.

![Figure 1](image_url)

**Figure 1.** With cloud computing, other companies host your applications.

With the advent of hosted cloud computing and storage, the opportunity to offer a DBMS as an outsourced service is gaining momentum, as witnessed by Amazon’s RDS and Microsoft’s SQL Azure. A database-as-a-service (DBaaS) is attractive for two reasons. First, due to economies of scale, the hardware and energy costs incurred by users are likely to be much lower when they are paying for a share of a service rather than running everything themselves. Second, the costs incurred in a well-designed DBaaS will be proportional to actual usage (“pay-per-use”)—this applies to both software licensing and administrative costs. The latter are often a significant expense because of the specialized expertise required to extract good performance from commodity DBMSs. By centralizing and automating many database management tasks, a DBaaS can substantially reduce operational costs and perform well.

### BACKGROUND DETAILS:

Before going in deep, this is very necessary to make discussion on following things:

- **What is database management system (DBMS)?**
- What is cloud computing?
- What are the benefits of cloud computing?

### WHAT IS DATABASE MANAGEMENT SYSTEM?

Database management system is a software package that control the creation, maintenance, and use of a database. It allows organizations to conveniently develop databases for various applications by database administrators (DBAs) and other specialists. A database is an integrated collection of data records, files,
and other objects. A DBMS allows different user application programs to concurrently access the same database. DBMSs may use a variety of database models, such as the relational model or object model, to conveniently describe and support applications. It typically supports query languages, which are in fact high-level programming languages, dedicated database languages that considerably simplify writing database application programs.

**WHAT IS CLOUD COMPUTING?**

Cloud Computing provides us a means by which we can access the applications as utilities, over the Internet. It allows us to create, configure, and customize applications online.

The term Cloud refers to a Network or Internet. In other words, we can say that Cloud is something, which is present at remote location. Cloud can provide services over network, i.e., on public networks or on private networks, i.e., WAN, LAN or VPN. Applications such as e-mail, web conferencing, customer relationship management (CRM), all run in cloud.

There are certain services and models working behind the scene making the cloud computing feasible and accessible to end users. Following are the working models for cloud computing:

**Deployment Models**

**Service Models**

**DEPLOYMENT MODELS:**

Deployment models define the type of access to the cloud, i.e., how the cloud is located? Cloud can have any of the four types of access: Public, Private, Hybrid and Community.

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**Public Cloud**

The Public Cloud allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness, e.g., e-mail.

**Private Cloud**

The Private Cloud allows systems and services to be accessible within an organization. It offers increased security because of its private nature.
Community Cloud
The Community Cloud allows systems and services to be accessible by group of organizations.

Hybrid Cloud
The Hybrid Cloud is mixture of public and private cloud. However, the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.

Service Models:
Service Models are the reference models on which the Cloud Computing is based. These can be categorized into three basic service models as listed below:
Infrastructure as a Service (IaaS)
Platform as a Service (PaaS)
Software as a Service (SaaS)

![Service Models Diagram]

**Figure 3. Service Models**

**INFRASTRUCTURE AS A SERVICE (IAAS)**
IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.

**PLATFORM AS A SERVICE (PAAS)**
PaaS provides the runtime environment for applications, development & deployment tools, etc.

**SOFTWARE AS A SERVICE (SAAS)**
SaaS model allows to use software applications as a service to end users.
WHAT ARE BENEFITS OF CLOUD COMPUTING?

Some of the cloud computing benefits are represented by given Figure 4.

**Figure 4. Cloud Computing Benefits**

**DBMS AS A CLOUD SERVICE:**

Most of the database management systems are software packages that are acquired by DBAs to create, manipulate and maintain the database. Now, because of the concept of cloud computing, DBMS has morphed into an entirely new type of service with its own unique benefits and task specific advantages. 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.

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.

Despite the benefits offered by cloud-based DBMS, many people still have apprehensions about them. This is most likely due to the various security issues that have yet to be dealt with. These security issues stem from the fact that cloud DBMS are hard to monitor since they often span across multiple hardware stacks and/or servers. Security becomes a serious issue with cloud DBMS when there’s multiple Virtual Machines (which might be accessing databases via any number of applications) that might be able to access a database without being noticed or setting off any alerts. In this type of situation a malicious
person could potentially access pertinent data or cause serious harm to the integral structure of a database, putting the entire system in jeopardy.

There is however a proposed method for dealing with these types of incongruence. An obvious solution is the deployment of an autonomous network agent, which rigorously monitor and defends all activities related to database access. The limitation of this method however, is that a network agent may be unable to handle extremely large and dense volumes of activity / traffic.

Arguably, the best solution for dealing with security issues is to employ continuous database auditing. This involves setting up a system that meticulously records, analyze and report on all activities regarding database access, especially suspicious database access. All information regarding these activities is logged and stored in an extremely remote and secure location with alerts being sent out to cloud management (or including any other individuals they might have designated to receive this information) in the event of a breach. This will provide those in charge of security with the information necessary to determine who is responsible, where they are located as well as the specifics of their machine / hardware.

Cloud databases are designed to run on a cluster of hundreds to thousands of nodes, and are capable of serving data ranging from hundreds of terabytes to petabytes. Compared with traditional relational database servers, such cloud databases may offer less querying capability and often weaker consistency guarantees, but scale much better by providing built-in support on availability, elasticity, and load balancing. On the other hand, data management tools are an important part of relational and analytical data management business since business analysts are often not technically advanced and do not feel comfortable interfacing with low-level database software directly. These tools typically interface with the database using ODBC or JDBC, so database software that want to work these products must accept SQL queries. Therefore, a novel technology to combine DBMS capability with Cloud scale scalability is highly desirable.

**NEED OF DBMS IN CLOUD:**

Initially, cloud DBMSs will have an impact for vendors desiring a less expensive platform for development. As cloud infrastructure with DBMSs gains maturity especially in scalability, reliability and security, cloud implementations used for short-term projects such as small departmental applications and rapid development platforms will show marked cost reductions compared with implementations within the IT department. This advantages reinforced by the ability to set up a cloud DBMS environment without the use of expensive IT personnel. The speed of setup will be a primary driver to rapid deployment of systems without the usual requirements and planning necessary for IT projects within the IT department. This will also reduce the necessity for IT to respond to short notice and short duration projects, reducing overall costs in IT. Data management applications are potential
candidates for deployment in the cloud. This is because an on premises enterprise database system typically comes with a large, sometimes prohibitive up-front cost, both in hardware and in software. For many companies (especially for start-ups and medium-sized businesses), the pay as-you-go cloud computing model, along with having someone else worrying about maintaining the hardware, is very attractive.  

Due to the ever-increasing need for more analysis over more data in today’s corporate world, along with an architectural match in currently available deployment options, we conclude that read-mostly analytical data management applications are better suited for deployment in the cloud than transactional data management applications. We thus outline a research agenda for large scale data analysis in the cloud, showing why currently available systems are not ideally-suited for cloud deployment, and arguing that there is a need for a newly designed DBMS, architected specifically for cloud computing platforms.

CONCLUSION

Database Management Systems as a cloud service are engineered to run as a scalable, elastic service available on a cloud infrastructure. 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.

REFERENCES