A REVIEW OF DATABASE SERVICES AND SERVICE PROVIDERS

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Abstract

This research seeks to understudy the various database services and service providers which are geared towards ensuring that databases are protected and monitored using a variety of techniques. Hence, in the course of this study, the various database services and service providers have been identified while highlighting the advantages of Database as a Service over traditional database systems as well as its disadvantages. Consequently, the research has identified a list of the current twenty best cloud service tools and their associated features have also been highlighted.

Keywords: Database, Database Services, Service Providers, Cloud Services.

1.0 INTRODUCTION

Database Services ensures that customer databases are protected and monitored by establishing backup and recovery procedures, providing a secure database environment, and monitoring database performance. Database services ranges from architecture design, Administration and Monitoring, Performance Tuning, Patch management, Optimization, Security Management, Database upgradation and migration and a host of others.

Several organizations are adept in the provision of diverse database services. These are referred to as database service providers and some offer database management system which exist as both close source and open source databases. Popular DBMS offerings include Oracle database, Microsoft SQL Server, IBM Db2 and MySQL. Some organizations specialize in the delivery of database management services for optimal database use. One of such services is the Database Maintenance solutions. Irrespective of the type of database systems in use (Oracle, Microsoft SQL or any other), it is imperative that the database is maintained for its smooth functionality. The team of Database Administrators comes with a large experience that is able to perform and offer highly sophisticated database solutions that are quick, scalable and effective.

Database as a Service relies on a cloud database to store, manage and access data. Cloud Computing Services facilitate the provision of Information Technology (IT) as a service over the Internet. Cloud computing is a broad term which is used for data storage and access over the internet. It does not store any data on the hard disk of your PC. Cloud computing helps one to access your data from a remote server. Cloud computing services range from full applications and development platforms to servers, storage, and virtual desktops. There are various kinds of cloud computing services in the market today. In a standard computing environment, the database server is part of the on-premises computing infrastructure and is installed, managed and run completely by an organization's IT staff. Conversely, the DBaaS model is a subscription service in which the provider maintains the physical infrastructure and database and delivers it as a private cloud service based on a fee. The service to be rendered typically covers high-level administrative burdens such as installation, initial configuration, maintenance and upgrades. More database administration (DBA) services, such as backup and performance management may also be provided for use. The customer has control over the content and usage of the database.

The DBaaS model is ideal for most businesses that do not have well-staffed IT departments. Offloading the service and maintenance of the database to the DBaaS

provider enables some of these businesses to implement applications and systems that they otherwise could not afford to build and support on-premises. Workloads involving data with thorough regulatory requirements may not be suitable for a DBaaS model. Additionally, mission-critical applications that require optimal performance and 99.999% of uptime may be better suited for on-premises implementation. This does not mean that mission-critical workloads cannot run on cloud services, but much of the DBaaS adoption to date has been for less crucial applications, such as development and pilot programs.

2.0 REVIEW OF RELATED LITERATURE

Database Services are meant to ensure that customer databases are protected and monitored by establishing backup and recovery procedures, providing a secure database environment, and monitoring database performance (Ricardo et al.,2017). Current enterprise depends on data to drive the business and performance. Availability of data is the key factor to run a competitive business. The advancements in technology have opened the floodgates for endless volumes of data to flow into the system. With this tremendous amount of data pouring in from diverse sources and in multiple formats, it becomes a critical task for organizations to store, process and manage this data. And even more so in today's data driven world, where it has become the key to business success. A robust and efficient database management system resolves all data worries, giving businesses the power to lead (www.cloverinfotech.com)

In order to ensure a successful database management system, there is need to carefully devise a strategy in alignment with the data requirements and business roadmap of the organization. Today, with numerous database options available in both open as well as closed source database categories, it is important to choose a database solution as per the volume, variety. SMAC (social, mobile, analytics and cloud) has resulted into a data explosion which is overwhelming for some organizations. Every second, large amount of data is being generated through a widespread network of data sources – images, graphs, hyper-text, documents, etc.

X-as-a-service (Xaas) models are differentiated by how much of the IT infrastructure is provided as a service over the internet. The IT infrastructure stack consists of: Networking, Storage, Servers, Virtualization, Operating Systems, Middleware, Runtime, Data and Database Management Systems and Applications. Diverse layers of this stack can be provided either on premises or as a cloud service. Other than completely on-premises models (where the entire stack is on site) and SaaS models (where the entire stack is remote), the three predominant XaaS models are database as a service (DBaaS), infrastructure as a service (IaaS) and platform as a service (PaaS).Infrastructure as a service (IaaS) offers virtualized computer resources over the internet to deliver the core infrastructure (networking, storage, servers and virtualization). The left-over is provided and managed by the customer. Platform as a service (PaaS) delivers additional components of the IT infrastructure. Typically, PaaS delivers networking, storage, server, virtualization, OS, middleware and runtime components. Database as a service (DBaaS) provides data layer services to the provided stack. A trusted infrastructure service management provider, ITSM offers Database Management Services to complete the overall maintenance of infrastructure. Organizational Internal IT team can focus on applications which drive business, while ITSM provides a stable and scalable infrastructure. The team proactively monitors and manages simple to complex databases, and collaborates with with its clients for tuning and optimization. Customers can subscribe to managed database service and receive comprehensive support for all aspects of the deployment, configuration, and maintenance of the database software, including clustering and replication.
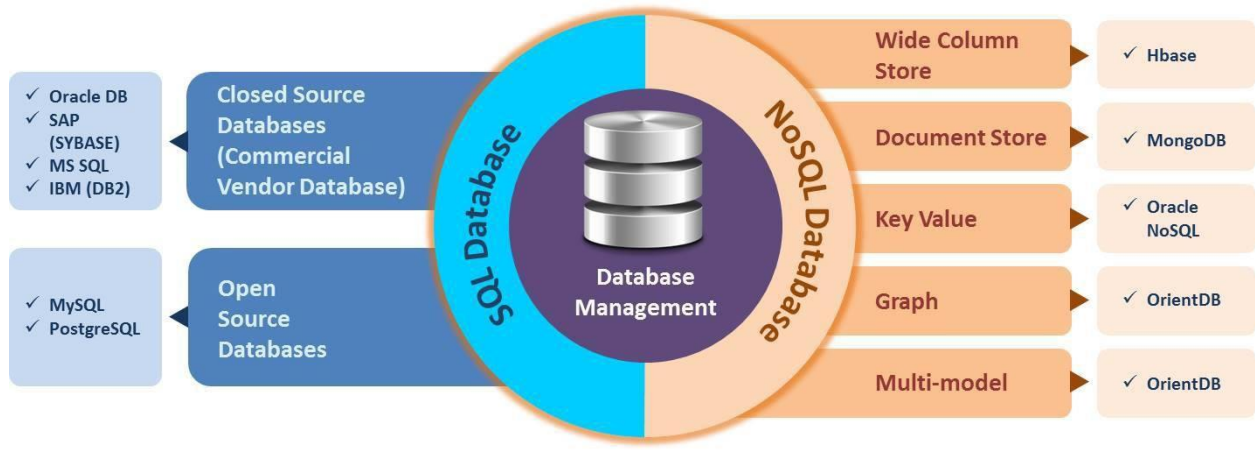
Figure 1. New age database management services. Retrieved from
www.cloverinfotech.com

AIM AND OBJECTIVES

The aim of this work is to understudy the various database computing services with its
associated service providers. The objectives are;

   (i)   To state the various database services

   (ii)   To state the various database service providers

   (iii)   Highlight the advantages and disadvantages of Database as a Service (DBaaS)
        over traditional database systems.

DISCUSSION

Database Services.

Administration and Monitoring: Database administrators (DBAs) use specialized
software to store and organize data. The role may include capacity planning, installation,
configuration, database design, migration, performance monitoring, security,
troubleshooting, as well as backup and data recovery.

Performance Tuning: Database tuning is used to describe a group of activities used to optimize and homogenize the performance of a database. It aims to maximize use of system resources to perform work as efficiently and rapidly as possible.

Patch Management: A patch constitute set of changes to a computer program or its supporting data designed to update, fix, or improve it. This includes fixing security vulnerabilities and other bugs, with such patches usually being called bugfixes or bug fixes, and improving the functionality, usability or performance.

Security Management: Database security involves a range of security controls designed to protect the Database Management System (DBMS). Database security encompasses multiple controls, including system hardening, access, DBMS configuration, and security monitoring. These different security controls help to manage the circumventing of security protocols.

Backup and Recovery Management: *Backup and recovery* refers to the process of creating and storing copies of data that can be used to protect organizations against data loss. This is sometimes referred to as *operational recovery*. Recovery from a backup typically involves restoring the data to the default location, or to an alternate location where it can be used for the purpose of replacing the lost or damaged data.

Database software support for Oracle and Microsoft SQL Server is available for any current release of versions supported by the database vendor. Both Oracle and SQL Server DBMS have the support of the DBA team.

Services provided with the standard database support package include:

- Preliminary installation of software, involving configuration and verification as the case may be
- Routine backups to disk, as directed by customer
- Disk space monitoring and management
- Restoration of database as required

- Rebuilding indexes of database, as required
- A primary on-call DBA to respond to alerts and customer related issues as defined by the level of customer support

Other available service options, depending on database software, include but are not limited to:

- Standby databases to facilitate business continuity
- Replication
- Cloning of database for development environments
- Data conversion or migration assistance
- Database query tuning
- Database upgrades/patching
- Database security maintenance
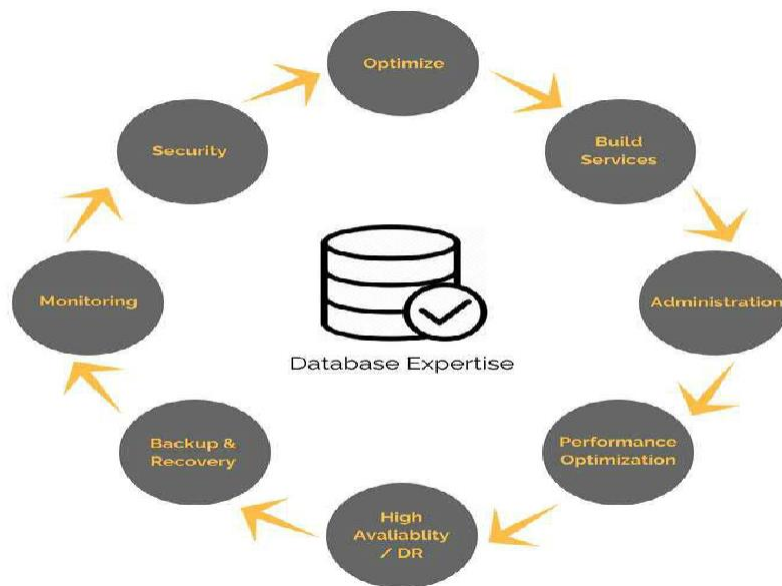
Figure 2. Database expertise. Retrieved from www.cloverinfotech.com

Database as a service

Database as a service (DBaaS) is a cloud computing managed service facility that facilitates the provision of access to a database without requiring the setup of physical hardware, the installation of software or the need to configure the database. Most maintenance and administrative tasks are handled by the service provider, freeing up users to quickly benefit from using the database. In a standard computing environment, the database server is part of the on-premises computing infrastructure and is installed, managed and run completely by an organization's IT staff. conversely, the DBaaS model is a fee-based subscription service in which the provider maintains the physical infrastructure and database and delivers it as a private cloud service.

DBaaS tools: DBaaS facility are available for both relational and NoSQL database types. Relational DBaaS offerings utilize an SQL database and are offered for traditional database management systems (DBMS) like Db2, Oracle, SQL Server and MySQL, as well as for cloud-only database systems like Amazon RDS and Azure. NoSQL DBaaS offerings span diverse DBMS types, including graph, document, wide column and key/value stores. Regardless of the type of cloud database, DBaaS facility offers elastic database services for application development, test and production deployment, typically with an easy-to-use web console and API. DBaaS relies on a cloud database to store, manage and access data. The cloud service and the database service must not be from the same provider. For example, an organization can use AWS for cloud service with a Microsoft SQL Server database. The first decision to make when adopting DBaaS is to choose a DBMS. Most of the popular DBMS offerings are available on multiple cloud service providers. Popular DBMS offerings are as follows;

- Oracle database

- Microsoft SQL Server

- IBM Db2

- MySQL

The next step is to decide which cloud service provider to use. Keep in mind that not every DBMS is supported on every cloud platform. Popular cloud service provider options include:

- AWS

- Microsoft Azure

- Oracle cloud

- Google Cloud Platform

Advantages of DBaaS

The DBaaS model has some specific advantages over traditional on-premises database system management, including:

- Reduction of management requirements -- the DBaaS provider is responsible for many management and administrative burdens.

- Elimination of physical infrastructure -- the infrastructure required to facilitate the smooth running of the database is provided by the DBaaS provider.

- Reduced IT costs -- users do not need to manage and plan for database hardware upgrades, thereby reducing cost

- Increased savings -- users do not need to invest in expensive hardware, because the physical infrastructure is no longer on premises. Additional savings can also come from reduced capital expenditures, less staff, decreased electrical and operating costs as well as a smaller physical space.

Disadvantages of DBaaS

There also exist disadvantages with DBaaS in comparison with traditional on-premises database technologies.

- Lack of control over the IT infrastructure is usually the most crucial issue with DBaaS versus an in-house solution. In a provider-managed infrastructure, an organization's technicians tend not to have direct access to the servers and storage used to run the database. If an organization's internet connection is down, or if the system experiences an outage at the service provider location, the organization will not have access to its data until the problem is fixed by the service provider.

- Security can also be a issue because it is controlled by the service provider and an organization will not have direct influence over the physical safety of the servers.

- Latency is also another concern. The additional time required to access enterprise data over the internet can cause performance issues. These performance issues grow when loading large amounts of data, which tends to be slow and time-consuming.

Database Service Providers
- **Microsoft:** On June 12th 1988, Microsoft joined Ashton-Tate and Sybase to create a variant of Sybase SQL Server for IBM OS/2 (then developed jointly with Microsoft), which was released the following year. This was the first version of Microsoft SQL Server, and served as Microsoft's entry to the enterprise-level database market, competing against Oracle, IBM, Informix, Ingres and later, Sybase. SQL Server 4.2 was shipped in 1992, bundled with OS/2 version 1.3, followed by version 4.21 for Windows NT, released alongside Windows NT 3.1. Today there are several versions of MS SQL Server (Microsoft, 2020).

- **Oracle: Oracle Corporation**, formerly **Software Development Laboratories (1977–79), Relational Software Inc. (1979–82),** and **Oracle Systems Corporation (1982–95)**. It is a global corporation that develops and markets computer software applications for business. The company is best known for its Oracle database software, a relational database management system, and for computer systems and software, such as Solaris and Java, acquired in its purchase of Sun Microsystems in 2010. Oracle is based in Redwood Shores, California (Wikibooks, 2020).

- **AWS**: Amazon Web Services (**AWS**) is a secure cloud services platform, providing compute power, database storage, content delivery and other functionality to help businesses scale and grow.

- **SAP**: **SAP** stands for Systems Applications and Products in Data Processing. SAP, by definition, is also the name of the ERP (Enterprise Resource Planning) software as well as the name of the company. SAP Software is a European multinational, founded in 1972 by Wellenreuther, Hopp, Hector, Plattner, and Tschira. They develop software solutions for managing business operations and customer relationships.

- **IBM**: IBM developed IBM Db2. It is a relational database that provides advanced data management and analytics capabilities for transactional workloads (Chang et., al., 2010). This operational database is designed to deliver high performance, actionable insights, data availability and reliability, and it is supported across Linux, Unix and Windows operating systems.

LIST OF 20 BEST CLOUD SERVICE TOOLS

Amazon Web Services

Amazon's cloud web hosting platform which provides fast, flexible, reliable and cost-effective solutions. It offers a service in the form of building block which can be used to

create and deploy different kinds of applications in the cloud. It is well known for its popularity as it was the first to enter the cloud computing space.

Features:

- Easy sign-up process
- Fast Deployments
- Allows easy management of add or remove capacity
- Access to effectively limitless capacity
- Centralized Billing and management
- Offers Hybrid Capabilities and per hour billing

Kamatera

A cloud server tool developed by Kamatera has similarities to a physical server. It operated in a virtual infrastructure cloud, making it highly flexible and cost-effective. This cloud server pricing is based on pay as you use model a standard in the industry.

Features:

- Data Centers within four continents for ultimate performance and availability
- Fully Customized VPS Hosting to fit user needs
- Scalability: Allows you to quickly modify some features such as; add load balancers, firewalls, private networks and apps such as: pfSense, Docker, CPanel, Drupal, Jenkins, WordPress, Magento, node.JS and many more.
- All SSDs with UNLIMITED TRAFFIC. 99.95% Up-Time Guaranteed
- Move across hundreds of servers in seconds
- Billing options – Per Month or Per Day

- 24/7/365 Tech Human Support
- Free Trial to test the services for 30 days

Digital Ocean

Digital Ocean's droplet is a scalable computer service. It is much more sophisticated than just virtual machines. This cloud platform provides add-on storage, security, and monitoring capabilities to facilitate and run production applications easily.

Features:

- It allows you to deploy your custom image, one-click app, or standard distribution
- It creates room for one to deploy Droplets and get a reliable connection and flat pricing across 8 data center regions
- It offers Option to select Standard Plans or Performance Plans according to your business needs.

Rackspace

Rackspace is another important cloud computer service tool. It offers services like hosting web applications, cloud files, cloud backup, database, and cloud server, and others.

Features:

- It brings about fast-migration to the Cloud
- It helps you to prepare your business for the worst-case scenario
- It offers work on pay as you go model, so you are charged base on your usage
- It helps you to use a combination of solid-state drives and hard drives to facilitate high performance

MassiveGrid

MassiveGrid provides Virtual and Dedicated Private Clouds. Virtual Private Clouds helps users to have the flexibility to manage their resources in their environment according to their business needs.

Features:

- It provides fast & reliable Network Infrastructure
- It makes Private cloud clients a secure web control panel, and it can be used 24x7x365 to manage their clouds
- It Offers high availability services with building a state-of-the-art infrastructure
- It is extremely fast and dedicated hardware.

Alibaba Cloud

Alibaba is one of the most popular and the largest Chinese cloud computing company. It is a new platform which created a global footprint with over 1500 CDN Nodes worldwide of 19 regions and 56 availability zones across more than 200 countries.

Features:

- It helps in achieving faster results
- It helps to protect and backup data
- It offers full management permissions and multiple management methods
- It provides highly stable applications and reliable data storage

LiquidWeb

The liquidweb provides cloud Sites which is a managed hosting platform which offers creatives freedom to build and launch websites without the need to learn cPanel or server management.

Features:

- It allows one to manage sites quickly and effortlessly
- It hosts Unlimited Sites & Apps with a single Account
- It does not require any server management skill
- The tool can easily be integrated with WordPress, Drupal, Joomla, etc.

Microsoft Azure

Azure is a cloud computing platform which was launched by Microsoft in February 2010. This open source and flexible cloud platform helps in development, data storage, service management & hosting solutions.

Features:

- Windows Azure provides one of the most effective solutions for data needs
- It Provides scalability, flexibility as well as cost-effectiveness
- It provides consistency across clouds with familiar tools and resources
- It allows you to scale your IT resources up and down according to your business needs

Google Cloud Platform

Google Cloud is a set of solutions and products which includes GCP & G-suite. It helps you to solve all kind of business challenges with ease.

Features:

- It allows you to scale with open, flexible technology
- It solves issues with accessible AI & data analytics
- It eliminates the need for installing expensive servers
- It allows you to transform your business with a full suite of cloud-based services.

VMware

It is a comprehensive cloud management platform that helps you to manage a hybrid environment running anything from traditional to container workloads. The tools also allow you to maximize the profits of your organization.

Features:

- It is an enterprise-ready Hybrid Cloud Management Platform
- It Offers Private & Public Clouds
- It facilitates the provision of comprehensive reporting and analytics which improve the capacity of forecasting & planning
- It offers additional integrations with 3rd parties and custom applications, and tools.
- It is flexible and provides agile services

Salesforce

Salesforce cloud computing provides multiple cloud services like Sales Cloud, Service Cloud, Marketing Cloud, etc. It helps one to accelerate production of the environment.

Features:

- Salesforce Service Cloud provides 24 * 7 support
- It allows you to take a right and decisive decisions about your business
- It assists in managing the customer's contact information, automating the business processes, etc.

Oracle Cloud

Oracle Cloud facilitates the provision of innovative and integrated cloud services. It helps you to build, deploy, and manage workloads in the cloud or on premises. It also helps companies to transform their business and reduce complexity.

Features:

- Oracle provides more options for where and how you make your journey to the cloud
- Oracle assists in the realization of the importance of modern technologies including Artificial intelligence, chatbots, machine learning, and lots more
- It offers Next-generation mission-critical data management in the cloud
- Oracle offers better visibility to unsanctioned apps and protects against sophisticated cyber-attacks, thereby facilitating cybersecurity

Verizon Cloud

Verizon Cloud computing platform facilitate the control of infrastructure with advanced set-up and customization options from a single user interface.

Features:

- It expands any workload quickly to help grow your business with less risk
- It helps to build the right cloud with performance, support, and flexibility to make business successful
- It allows one to select flexible service need according to organizations' need
- It assists to trim down the risk and retain the data integrity across the apps

NaviSite

NaviSite provide cloud services for enterprises and mid-sized businesses by using the best IT technologies. It provides a range of cloud service solutions like Cloud Infrastructure services, Cloud desktop, and hosting services.

Features:

- NaviSite simplifies application management services which include Managed Office 365 services

- It provides cloud-based Infrastructure-as-a-Service (IaaS) solutions that comprise managed cloud and self-service cloud solutions
- It helps one to simplify desktop management and administration

IBM Cloud

IBM cloud refers to a full stack cloud platform which spans public, private and hybrid environments. It is built with a robust suite of advanced and AI tools.

Features:

- IBM cloud provides infrastructure as a service (IaaS), software as a service (SaaS) and platform as a service (PaaS)
- IBM Cloud is used to build pioneering which helps you to gain value for your businesses
- It provides high performing cloud communications and services into your IT environment

OpenNebula

OpenNebula is a cloud computing platform. It allows the management of heterogeneously distributed data center infrastructures. It assists one to manage the data center's virtual infrastructure to build private, public and hybrid implementations.

Features:

- Easy to install, use, maintain, and operate
- Provides greater functionality for private & hybrid clouds
- Highly-scalable, reliable, and commercially supported

Pivotal Cloud

Pivotal cloud foundry which is often known as PCF is a proven digital solution for businesses. It helps one to move faster toward a software-driven future.

Features:

- It accelerates feature delivery
- It is specially designed tool for zero-downtime deployments
- It aids one to reduce risk in your app portfolio
- It delivers enterprise SLAs (Service level agreement) at scale

CloudSigma

It is a flexible cloud server, and virtual private server hosting solutions. It offers a straightforward and transparent approach for pricing. One can easily stream at multiple gigabit speed from their cloud servers.

Features:

- It helps one to achieve complete control and flexibility over your cloud environment
- It aids in mixing & matching all SSD and magnetic storage
- This cloud computing service tool is certified as compliant with the highest ISO 27001 requirements for security and data privacy

Dell Cloud

Dell provides a cloud platform, cloud-enabled infrastructure, models, and serves in a single place. It creates room for selection from reference architecture, integrated and public cloud platforms.

Features:

- It offers Cloud that works with your existing operations
- It provides Cloud consumption using Dell Financial Services
- It accelerates your transformation with expert cloud services if a cloud which was developed by Quadranet is fully scalable and reliable cloud infrastructure, the tool is billed hourly based on your line resource size which you can view a breakdown of the cost associated with each resource.

Quadranet

QuadraNet is a fully integrated multi-site solutions provider with data center services

Features:

- QuadraNet's uptime SLA comes default with all cloud configurations
- The InfraCloud supports a wide variety of OS like CentOS to FreeBSD to Windows
- The custom interface helps in managing InfraCloud instances

OnePortal

OnePortal Rapid is built with the latest open-source technology to provide fast, feature rich, highly scalable cloud platform.

Features:

- It helps one to build and deploy applications with standard OpenStack based API libraries
- OpenStack Horizon web dashboard allows easy tracking and management of cloud

- Flexible billing method ensures that only resources used are paid for.
- Scale quickly with additional compute and storage resource

Tips for selecting a Cloud Service Provider

The "best" Cloud Service cannot be defined. One need to a choose a cloud service "best" for your project. Following checklist will help:

- Is your desired region supported?
- Cost for the service and your budget
- For an outsourcing company, Customer/Client Preference of service provider needs to be factored in
- Cost involved in training employees on the Cloud Service Platform
- Customer support
- The provider should have a successful track record of stability/uptime/reliability
- Reviews of the company

6.0 CONCLUSION

Several database services groups are adept in providing services across technology environment including Oracle, MS SQL Server, Db2, etc. DbaaS relies on a cloud database to store, manage and access data. The cloud service database service need not be from the same provider. Any organization should ensure that it has the proper tools to manage databases and build applications using DbaaS implementation it has chosen. Finally, an organization's IT staff should be sure to understand the tooling that is offered by their chosen service provider as most DBaaS and cloud service providers supply tools to help customers use their services.

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