



# CONESTOGA

Connect Life and Learning

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## Introduction

In today's modern corporate world, where uninterrupted operations and service availability of data are necessary to ensure that operations are smooth and effective in their operations. The CTO has asked to come up with a plan for reducing the most downtime or not having a plan so that users don't observe any kind of downtime while performing the upgrade or any activity on the databases. The reason for selecting and adopting Microsoft Azure is to enhance data access to all the connected applications and users even if any upgrade or any activity is being performed—the purpose of selecting a cloud-based solution with a more elastic and robust database. While upgrading reduces downtime, interruption of database unavailability during an outage through flexibility between cloud database and on-premises infrastructure will ensure the data is always available and operational. Considering this option for the integration process of Microsoft SQL Server hosted in the Cloud and Azure SQL Database. The ease of flexibility, complexity, compatibility, cost, and upkeep of the database with organizational practice determines the use as per standards. The most cost-effective, highly available, and self-managed Azure SQL Database is the most efficient managed platform as a service.

Azure SQL Data Sync is a tool available offers Bidirectional data sync in the Azure Cloud platform, used to check changes that happened and tracking tables to ensure the availability of real-time updates to avoid data differences between on-premises and cloud DBs is part of it. For uninterrupted service, a failover plan is also provided so the users have easy access to a cloud-based database. This integration approach helps corporate environments enhance their availability and performance by using the capabilities of Azure that deliver a scalable, reliable, and hybrid database.

## In-Class Research

### **What is Advantage of Selecting Azure SQL Database feature**

“Azure SQL Database is most reliable, and it has latest patches available. It is PaaS and focuses on configuration specific with number of databases selected to sync. This service brings Performance to the organization with high accessibility, reliability, and availability rate.” (WilliamDAssafMSFT, 2024a)

### **Which Service in Azure is best**

**-Azure SQL Database, Azure SQL Managed Instance or Azure SQL Server.**

#### **“1. Azure SQL Database**

It avails many features to work with On-premises SQL Server and Azure SQL Database; It is a robust platform as a service on the Azure portal. Azure SQL Database provides better service in terms of scaling up and down availability for demand-related applications. With other services from Azure cloud helps to address demand as per the need of the databases. For management and deployment of databases, features like Geo-replications allows to handle databases in different regions on Azure Portal. Features used by compliance are Azure SQL auditing and Transparent Data Encryption.

#### **2. Azure SQL Managed Instance**

It provides 100% compatibility with the latest SQL Server Database (Enterprise Edition), and it is a fully managed database service. It is a combination of both On-premises SQL Server and PaaS. It provides smooth migration for applications dependent on SQL Server Features. This Service reduces administrative involvement, whereas benefits with better computing performance and advance database capabilities.

#### **3. Azure SQL Server**

It is the same like hosting SQL server on the On-premises infrastructure, but hosting VM with Azure SQL server removes infrastructure cost as well as it benefits of scaling the server up and down. Azure SQL Server provides cluster availability with better uptime. It requires more administrative involvement than other features, patches, updates and version, failovers and other activities need to be taken care of the server.” (Huijgen, 2021)

## Plan Timeline

Evaluating Data to Sync	1 week
Version Check of Cloud and On-premises Servers	3 days
Installing SQL Data Sync Agent	1 day
Performing Backup	1 day
Performing Deployment	2 days
Restoration in case issue faced	1 day
Monitoring operations and applications	2 days
Performing Failover	1 day
<b>Total</b>	<b>2 weeks 4 days</b>

## Breakdown of Tasks

### Task 1

Take full Backup of the production MS SQL Server Database and move the backup to the storage location.

### Task 2

Configure Azure SQL Database Agent on on-premises Servers.

### Task 3

Test the connection and configuration between MS SQL server and Azure SQL Server Database.

### Task 4

Check the storage capacity of the Azure SQL Server Database.

### Task 5

Schedule the backup timing and Shift traffic to the Azure SQL Server Database whenever the downtime/maintenance/Activity or disaster occurs. The Azure SQL Server database will be available, and users will be able to access the service and operability of the SQL Database and its application users.

## Key Milestones

1. Evaluate the Databases to be synchronized with MS SQL Server and Azure SQL Server.
2. Check version compatibility and estimate time to perform deployment and documentation.
3. Once approvals are received from the stakeholders and higher authorities.
4. Perform Activity on UAT servers and Azure cloud to check the compatibility and connection thresholds.
5. Successfully configure Azure SQL Sync Agent between the on-premises Server and Azure SQL Server database.
6. Perform Sync of data on both On-premises Server and Azure SQL Server.
7. Perform Failover/shift traffic on the Azure SQL Server database to check the database connections.

## Plan notification schedule

1. Publish the Activity timeline in brief in the organization and the purpose of the activity to everyone in the organization.
2. Publish the list of departments, applications, and operations that will be impacted due to this activity and explain the benefits of performing the activity, and provide restoration if something goes unplanned.
3. Perform the activity as per the timeline scheduled during off-working hours.
4. Post-completion of activity perform failover, Test data traffic on Azure SQL Server database with running of applications and other organizations connections with SQL Server Database and its users.
5. If everything is successfully performed, send Activity completion mail to all the stakeholders.

## Detail breakdown of the problem

There are changes of multiple issues faced while deploying, maintaining, updating, or changing the configuration. A few of them are mentioned below:

“1. Sync fails between On-premise SQL Server database and Azure SQL Server.

Cause: This may occur due to insufficient space on the drive. Error

### **System.IO.IOException**

Solution: Add or create more space on the disk to continue the operations.

2. Sync Group stuck in process state, or stopped Syncing.

Cause: This is due to the client agent being offline, uninstalled, or missing.

Solution: Checking the configuration again and confirming the Azure SQL Data Sync agent is installed and online as well as properly configured. Restart the SQL data Sync services.

3. Unable to delete Sync group in 3 mins of uninstalling or stopping agent.

Cause: unable to delete sync group

Solution: remove sync group from the sync agent connected while online.

Remove XML file from the SQL data sync installation folder.

4. A Sync group faces Out-of-Date status

Cause: If sync or changes fail to complete since last successful sync within 45 days

Solution: The sync status needs to be updated and sync within every 45 days to avoid this error; if it is Out-of-Date, then delete the sync group and recreate it.

5. Erroneous data in tables

Cause: This happens due to tracking the same tables having the same name but of different schemas. Due to this both tables are reflecting in same tracking table.

Solution: Make sure tables are in different syncs, even if tables are from different schemas in different databases.” (WilliamDAssafMSFT, 2024b)

“6. Cannot connect to server due to firewall issues

Error code: **40615, 5 Cannot connect to <servername>**

Solution: port 1433 is required to be open in outbound firewalls so they can connect the Azure portal feature and the client-server.” (Suresh-Kandoth, 2024)

## Explaining deployment method and providing examples of why

There are different ways to perform this deployment, but the 2 best ways to perform are by deploying Azure SQL Database Service on Azure cloud or Creating VM on Azure Cloud and deploying Admin managed VM with hosting MS SQL Server on it.

### 1. VM hosted with MS SQL Server on Azure Cloud

- ➔ This is the same as the on-premises MS SQL Server; it requires administrative management, frequent downtime is taken, upgrades and updates are done manually, and scaling up and down is done by cloud services.

**Example:** Dollarama, DollarTree, Small companies, or mid-size companies can use this approach to handle the SQL server database requirements in day-to-day operations.

### 2. Azure SQL Database

- ➔ This is the latest, new, and reliable approach; in this, Security and infrastructure services are taken care of by Azure cloud; storage and scalability up and down can be managed by Azure cloud; it is very cost-effective and reliable, with less administrative involvement such as upgrading and updating. Low ratio of downtime in comparison to other approaches.

**Example:** CIBC Bank can use this approach so that their users can access the cloud Azure SQL Server database whenever required; it reduces the dependability of the on-premises servers.



## Explanation of data synchronization to the cloud.

### **1. Which method do you prefer to deploy? A cloud hosted MS SQL server or using the Azure SQL service? Please explain your decision and provide supporting material in your decision.**

The 2 options have different advantages and different ways to use the cloud-hosted services. The benefits and differences are mentioned below points.

#### **“Azure SQL Server database**

**Way to use:** It is a modern cloud-native application.

**Why choose this option:** It is fast for provisioning databases, and it helps with the scalability and elasticity of the database capacity.

**How to manage:** It can be managed as Full database management, no additional SQL Server Instance Management, and no OS management.

**New Versions:** New features are always available first.

**Upgrading options:** In this option, an up-to-date database engine is always available; no need to upgrade.

Virtual Network support is not available in this option.

It is the least expensive in terms of cost management.

High Availability and Disaster Recovery are built-in features in this option.

**Backup/ restore of the database:** Microsoft manages all kinds of backup/restore options, but there are no options for incremental or differential backups, and all restores are full restores

**Auditing:** Azure auditing tool is used for Azure SQL database.

#### **SQL Server hosted on cloud Virtual Machine**

**Way to use:** It uses a lift and shift approach; It is just like using and rebuilding the old way, applications that require OS-level access to the database server.

**Why choose this option:** It requires DTC and polybase functionality. It also requires features like SQL server Analysis, reporting services and integration services, and access to third-party applications on OS.

**How to manage:** It can be managed as Full Database Management, it also requires Total SQL Server instance management plus Full OS management.

**New Versions:** New Features come after Azure SQL Server release, so it is not the first to experience.

**Upgrading options:** It requires administrators to manually upgrade the database and the OS.

Virtual Network Support is available to manage the database.

It is the most expensive in terms of cost management.

Administrators have to set up for high availability through MS SQL manual features like Database Mirroring or availability groups.

**Backup/restore of the database:** Administrators have to Manually backup/restore its configuration setups, whether it is an incremental backup, full backup, or different kinds of restores.

**Auditing:** Third party software is used for auditing as well as SQL default tracing feature is used.” (OpsRamp, 2023)

In my view, the Azure SQL Server database is acceptable and beneficial in multiple ways, as well as cost-effective and easy to operate.

## **2. How will you plan out data -synchronization between the on-premises databases to the cloud-bases databases?**

To achieve data synchronization between the on-premises databases to the cloud based databases there are few tools used are mentioned below.

1. Azure SQL Data Synchronization
2. SQL Server replication (Transactional or Snapshot)
3. Azure Data Factory
4. SQL Server Integration Services (SSIS)

The best option available in this scenario is using Azure SQL Data Sync feature.

The plan to perform data synchronization between the on-premise and cloud based database is to setup data sync in Azure portal

Data Sync uses hub and spoke model where in selected databases are synced on the portal, so whenever there is an activity performed. Data is accessed from cloud, so data is always available to the applications and users to access.

“The advantages of Azure data sync are it supports bi-directional data sync, the complexity level is low as compared to other tools for syncing data, and It can handle a moderate level of data.

Whenever on-premises downtime is taken into account, data are synchronized on the cloud, and real-time support is scheduled. Through the Azure portal, it is easy to set up and manage the data.

The plan to perform the data sync is first to take a full backup locally and then perform the next step to configure active sync.

Install and configure the tool called Sync Agent on the on-premise server and register the on-premise SQL Server with the Sync Agent. Select the tables and databases to sync with the cloud.

Select the sync direction to sync, such as bi-directional or one-way, to the Azure cloud portal.

The last action is to schedule the sync for automatic synchronization.”  
(WilliamDAssafMSFT, 2024)

### **3. What will be your process in the event to have the business users point to the cloud-based solution when the on-premises environment is down due to updates or due to an outage?**

The process in the event of outage or when the environment is down due to updates or due to other circumstances the Azure Data Sync and Azure SQL Server Database comes into the picture.

In different scenarios, different cases, different approaches are used such as

**“Hybrid Data Synchronization:** In this, the data is synchronized between both the SQL server and Azure SQL database. This helps business users to move to the cloud and reduces dependencies on on-premise SQL servers.

**Globally Distributed Applications:** In this case many users and database are distributed in various locations and regions, to minimize the dependency on on-premises servers, That data is sync on Azure cloud.

**Distributed Applications:** In an organization, different applications use different databases as per their need and their uses. Some applications use databases for reporting, analysis, and other uses. Data sync helps to sync the data and reduce the risk of loss and cost effective approaches towards the downtime and impact of unavailability of data.

### **How it works**

The below explanation highlights the working of Azure Data Sync between the Azure SQL server and the on-premises SQL Server.

After configuring the Active Data Sync on the On-premises SQL Server and Azure SQL Server, the data is being tracked changes. The Changes such as insert, update, and delete change the data in the table on the user database. At every few intervals, FIRE\_TRIGGERS options on the changes in data happened in the on-premise SQL server. With this trigger, it catches the changes and updates the data on the Cloud database.

**Synchronisation of data:** It works as Hub and spoke model, Wherein the hub syncs the database individually. With triggers, it updates the changes happening on the hub are downloaded with the help of Azure data sync agent installed on-premise SQL server. This acts visa versa. The changes on the Hub are replicated to the member, and changes that happened on the member are replicated/synced on the Hub.

In case there is a conflict, the default priorities configuration wins; if Hub is configured as a winner, then will overwrite changes on members; similarly, if configured as a member on priority, the data is overwritten on Hub.”

(WilliamDAssafMSFT, 2024b)

## Explanation of back-up and recovery procedures for user connectivity and data integrity

There are different types of backup and recovery procedures available for ensuring user connectivity and data integrity; below are the few options used to perform the same.

### **“1. Long-Term Backup Restore**

- ➔ This feature is used to restore backup at any time on any server, whether it is a cloud SQL server or an on-premises Server. Go to a logical server in the Azure portal and select the long-term backup to restore the database. Select the Backups under Data Management and manage under available long-term backups restore.

### **2. Geo-Restore**

- ➔ This feature is used to restore databases in different regions if a particular region where the database or backup is located gets down due to some reasons. It allows databases in different regions without any compromise. So that Client users can access it and restore it from the Azure cloud portal, which can also be called geo-replication restoration.

### **3. Active Geo-Replication**

- ➔ It is mostly used for saving critical application data as it can be considered a disaster recovery solution. Periodic failover drills, data updation, backups and fault tolerance must be verified and checked or inspected at regular intervals.” (Dnethi, 2024)

## Conclusion

Integration of Microsoft Azure cloud-based database with an on-premise Microsoft SQL server is a strategic step and a better plan to provide service and data availability with advanced data access, elasticity, and security. By implementing this plan, the organization will be able to reduce costs of infrastructure and its maintenance; it will also enhance reliability and security to make sure that the services are always available and operable by using the Azure SQL Database feature as a service from Azure Platform. Between On-premises and Cloud databases, the Azure SQL Data Sync helps to sync the data seamlessly. Before selecting any cloud database, the failover plan should go through testing on which they can continue to access even while activity is in progress or maintenance, shut down, or any other emergencies are ongoing on-premises database. This plan helps to keep operations up and working due to efficiency and reduced downtime. Overall, this plan helps the organization grow, and dependability on the on-premises database is reduced for any kind of activity, maintenance, or emergency. The organization will be able to manage the database with reduced database downtime and low cost while having the highest available data access time.

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