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# An Algorithm to synchronize the local database with cloud Database

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***Abstract* - *Since the cloud computing [1] platform is widely accepted by the industry, variety of applications are designed targeting to a cloud platform. Database as a Service (DaaS) is one of the powerful platform of cloud computing. There are many research issues in DaaS platform and one among them is the data synchronization issue. There are many approaches suggested in the literature to synchronise a local database by being in cloud environment. Unfortunately, very few work only available in the literature to synchronise a cloud database by being in the local database. The aim of this paper is to provide an algorithm to solve the problem of data synchronization from local database to cloud database.***

***Keywords:* *Cloud computing, distributed system, database synchronization, Platform as a Service***

## I. INTRODUCTION

Cloud computing [14] is getting popular and IT giants such as Google, Amazon, Microsoft, IBM have started their cloud computing infrastructure. Data synchronization [1, 19] is the technique to maintain consistency among the data from source located at one place to a target located at another place and vice versa. Window Azure [8] is cloud based services which offers various platform independent services. With cloud environment you can quickly create database solutions that are built on the SQL Server (RDBMS) database engine. You can create a new SQL database then configure it later. You can decide whether to use an existing SQL database server or create a new one when you create your new database you can also import a saved database from Binary Large Object (BLOB) storage into SQL Database. Once you've created your new database, create new tables, import data, create and stored. Your data is safe on cloud server because it's stored in one primary data centre and two replica data centres.

In distributed system design [11],data synchronization is one of the major striking aspect of the distributed system users as the overall system consist multiple clients and a single server and whatever changes are made in client/server side database or vice versa should properly synchronized over time in order to maintain data integrity. Synchronization techniques are applied to synchronize the data between the two systems. In computer science field, synchronization generally refers to the idea of maintaining data integrity or keeping multiple copies of a data set in coherence with one another. Data synchronization is usually implemented using process synchronization primitives. Few research works has carried out in this area and very few algorithms have been developed to synchronize data from local database to cloud based database. In the proposed work we have suggested an algorithm to synchronize a local data base with a cloud copy and incase the server is unavailable, the suggested algorithm ensure the synchronization whenever the server reconnect, without any data loss. Traditional data storage techniques [4, 13] like client-server architecture has many drawbacks such as more infrastructure cost, high possibility of data loss, less availability and Congestion in network. All these problems are overcome with cloud storage approach. In this case, data will be stored in the cloud providers space which can be accessed from anywhere in the world with adequate security provide a kind of comfort to the data users.

### A HIERARCHICAL VIEW OF CLOUD COMPUTING

Cloud computing employs a service-driven business model. In other words, hardware and platform-level resources are provided as services on an on-demand basis. However, in practice, cloud services can be grouped into three categories: infrastructure as a service (IaaS). Platform as a service (PaaS) and Software as a Service (SaaS).

Infrastructure as a Service: Built on top of data centers layer, IaaS layer virtualizes computing power, storage and network connectivity of the data centers, and offers it as provisioned services to consumers. Users can scale up and down these computing resources on demand dynamically. Typically, multiple tenants coexist on the same infrastructure resources. Examples of this layer include Amazon EC2, Microsoft Azure Platform. Platform as a Service: PaaS [7, 14], often referred as cloudware, provides a development platform with a set of services to assist application design, development, testing, deployment, monitoring, hosting on the cloud. It usually requires no software download or installation, and supports geographically distributed teams to work on projects collaboratively. Google App Engine, Microsoft Azure, Amazon Map Reduce/Simple Storage Service are among examples of this layer. Software as a Service: In SaaS [7, 14], Software is presented to the end users as services on demand, usually in a browser. It saves the users from the troubles of software deployment and maintenance. The software is often shared by multiple tenants, automatically updated from the clouds, and no additional license needs to be purchased. Features can be requested on demand, and are rolled out more frequently. Because of its service characteristics, SaaS can often be easily integrated with othermashup applications. An example of SaaS is Google Maps, and supports multi-tenancy feature by utilizing single application instance model. The isolation among tenants is taken care by the underline design. Other services include subscription management, federated ID management, application firewall, etc.

## II. LITERATURE REVIEW

There are some research work found related to my selected area of study. Followings are under here.

In paper [11] C.Dutta et al.; describes synchronization algorithms of mobile database in cloud environment. This paper suggests SAMD (Synchronization Algorithms based on Message Digest) in order to resolve the problem described in paper [11]. SAMD resolves synchronization problems using only standard SQL queries as certified by the ISO (International Organization for Standardization). This is followed by a possible synchronization of any data combination regardless of the kind of database of server side or mobile database. The SAMD algorithm[11],[21] makes the images at the server-side database and the mobile database uses message digest tables to compare two images in order to select the rows needed for synchronization. If the two images are different, the synchronization progresses according to synchronization policy. In conclusion, the SAMD is effective solution for mobile database synchronization in cloud environment.

In paper [2] S. V. Krishna proposed an algorithm to synchronize the file between user devices and cloud storage when they are connected to internet. In this project, the user can upload file from mobile or PC to the cloud storage. These uploaded file will be automatically synchronized to the user's devices when they are connected to internet. So, user files can be viewed from anywhere by any device. In the existing system, we need to download files manually. This paradigm provides the user to synchronize data automatically between devices. As a test case they have implemented this algorithm for windows platform.

In this paper [15] I. Shabani et al.; presented an algorithm for data synchronization based on Web Services (WS). This algorithm allows software applications to work well on both configurations "Online" and "Offline", in the absence of the network. This algorithm are suitable in a scenario of uncertain supply of electricity, disconnecting the network and for other reasons which are not under the control of professional staff that manages the performance of running application, has interruption to the online work. In order to continue working in such conditions, are founded adequate solutions to work in offline mode and later data synchronization in normal conditions.

In this paper [18] authors (S. G. Zucker and S.Wang,) had explained that Data synchronization is required for supply chain management in the B2B e-commerce environment. This case study examined the impact of the adoption of data synchronization on three large consumer product goods organizations. The study identified process and structural inadequacies that developed as the result of the implementation, as well as how these organizations recognized benefits and future opportunities after data synchronization adoption. The findings revealed the significance of internal alignment around data cleansing and accuracy, as well as opportunities for improved external alignment from a systems perspective. The synergy created between product item management, data synchronization, and internal champions existed at all three companies. The workflow re-design, process improvements and standards development imposed on these organizations by the clean data requirement of data synchronization provided the greatest benefits from the data synchronization process.

This paper [20] K.Donkena and S. Gannamani attempt a method to evaluate performance of cloud database and traditional database in term of response time while retrieving the data. There has been an exponential growth in the size of the databases in the recent times and the same amount of growth is expected in the future. There has been a firm drop in the storage cost followed by a rapid increase in the storage capacity. The entry of Cloud in the recent times has changed the equations. The Performance of the Database plays a vital role in the competition. In this research, an attempt has been made toevaluate and compares the performance of the traditional database and the Cloud Database.

## III. PROPOSED TO WORK

Microsoft window azure cloud platform is based on a unique, unified, and integrated approach, which is used as cloud data storage. In order to address the problem of data synchronization from local database to cloud database we have used Microsoft Window Azure as cloud service provider.

**ALGORITHM STEPS ARE UNDER HERE.**

A. CONNECT TO SERVER

1. Check the availability of server
2. If not available then
   *{*
   *Create a server*
   *}*
3. Check the availability of database and operational table.
4. If not available then
   *{*
   *Create database and operational table as well as one temporary table with two column (ID, Timestamp)*
   *}*

B. CREATION OF STORED PROCEDURE ()

1. Setup linked server to link between local database server and clod database server.
2. Create a stored procedure using SQL
3. Fetch the latest data from the operational table by joining with temporary table ID and timestamp column.
4. Return the latest un-matched record.
5. Insert latest record to cloud database table.

C. CREATE SQL AGENT

1. Create the SQL server agent.
2. Create a new job set the stored procedure to the job.
3. Schedule the job to run.

## IV. EXPERIMENT AND RESULTS

For performing test cases and getting results we have considered Microsoft window azure as cloud service provider and SQL server as relational database.
Following steps are essential in order to perform test cases.
Log on to manage.windowsazure.com and select SQL database option. Create database and table structure in window azure. The database and table structure should be the same as local database.

1. *Click the New button found on the upper left-hand corner of the Azure portal.*
2. *Select Databases from the new page, and select SQL Database from the Databases page.*
3. *Fill out the SQL Database form with the required information upper left-hand corner of the Azure portal*
   - *Database name: mySampleDatabase*
   - *Resource group: myResourceGroup*
   - *Source:Sample (AdventureWorksLT)*
4. Click Server to create and configure a new server for your new database. Fill out the new server form specifying a globally unique server name, provide a name for the Server admin login, and then specify the password of your choice.
5. Click Apply.
6. Click Create to provision the database. Provisioning takes a few minutes.
7. On the toolbar, click Notifications to monitor the deployment process.

**CREATE A SERVER-LEVEL FIREWALL RULE**

Follow these steps to create a SQL Database server-level firewall rule for your client's IP address and enable external connectivity through the SQL Database firewall for your IP address only.

1. Click Set server firewall on the toolbar The Firewall settings page for the SQL Database server opens.
2. Click Add client IP on the toolbar and then click Save. A server-level firewall rule is created for your current IP address.

After the deployment completes, click SQL databases from the left-hand menu and click your new database, mySample Database, on the SQL databases page.

After followed above steps, test the connection of window azure database from local SQL server using following credential.

SERVER NAME, LOGIN AND PASSWORD.

FOLLOW THESE STEPS TO SETUP JOB IN LOCAL DATABASE:

1. *Create linked servers on local database to link between local database server and window azure database server.*
2. *Create a stored procedure on local database then just do a normal select query with a join with temporary table.*
3. *Fetch the latest data from the operational table by joining with temporary table ID and timestamp column.*
4. *Within stored procedure write a INSERT statement to insert fetched local data to cloud database.*

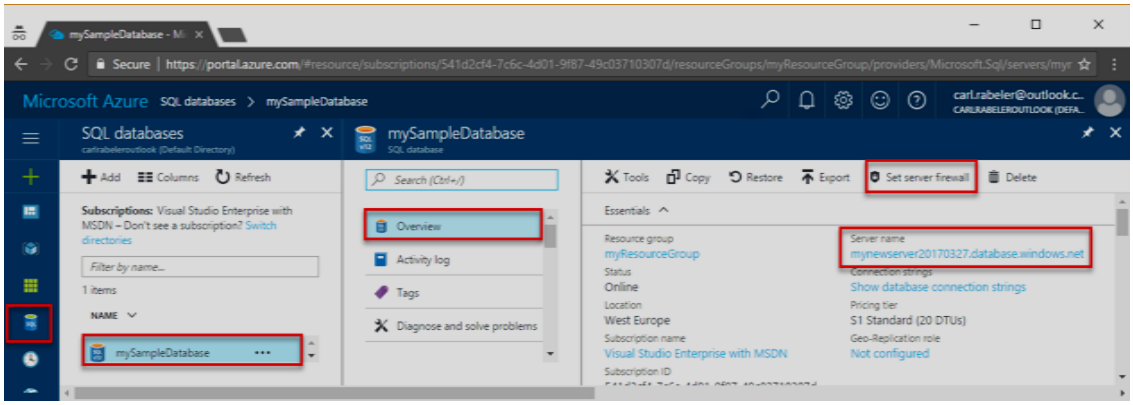



*Figure 1*

5. *Expand Sql server agent in SQL database engine.*
6. *Right-click Jobs, and then click New Job.*
7. *On the General page, in the Name box, type a name for the job.*
8. *Clear the Enabled check box if you do not want the job to be run immediately following its creation. For example, if you want to test a job before it is scheduled to run, disable the job.*
9. *Then, you can choose which logins you decided to authorize and category also choose what we needed.*
10. *Click new and give new name, then what type of language is to be selected. I am selecting T-SQL.*
11. *After selecting this, you have to insert your queries like this or by using open button; you have to browse your stored procedure.*
12. *If job is a failure, what's next? You can run another job or quiet the job.*
13. *Also, you can save that success or failure in a T-SQL format set path for output.*
14. *After completing all these steps which login to perform this job, so you choose logins.*
15. *Click ok, and then click on the SCHEDULING tab. Set the one hour interval.*
16. *Give the name that you already created, time, occurs, time, date for user option.*
17. *Finally click on OK to finish the configuration.*

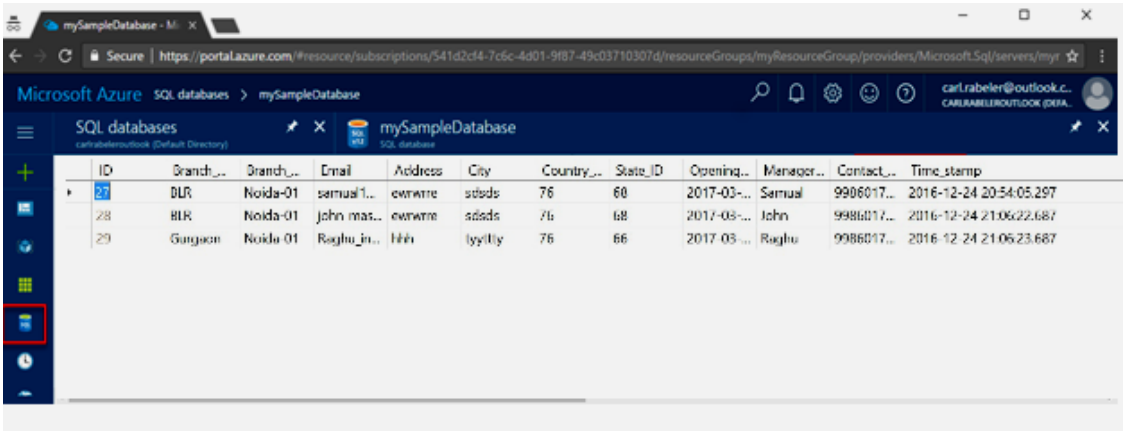
Note: If any transaction fails during synchronization this SQL agent will send data to cloud database in next time slot.

## RESULTS:

### CASE1: LOCAL DATABASE TABLE DATA

| ID | Branch_... | Branch_... | Email | Address | City | Country_... | State_ID | Opening... | Manager... | Contact_... | Time_stamp |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | BLR | Noida-01 | samual1... | ewrwrre | sdsds | 76 | 68 | 2017-03-... | Samual | 9986017... | 2016-12-24 20:54:05.297 |
| 28 | BLR | Noida-01 | john_mas... | ewrwrre | sdsds | 76 | 68 | 2017-03-... | John | 9986017... | 2016-12-24 21:06:22.687 |
| 29 | Gurgaon | Noida-01 | Raghu_in... | hhh | tyyttty | 76 | 66 | 2017-03-... | Raghu | 9986017... | 2016-12-24 21:06:23.687 |

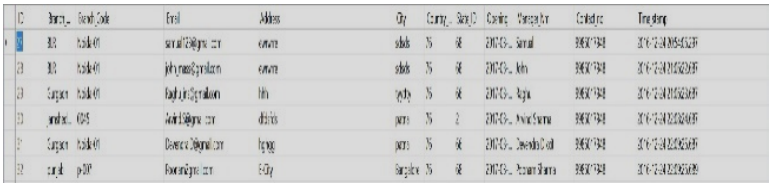
After invoked Sql agent check window azure database table.



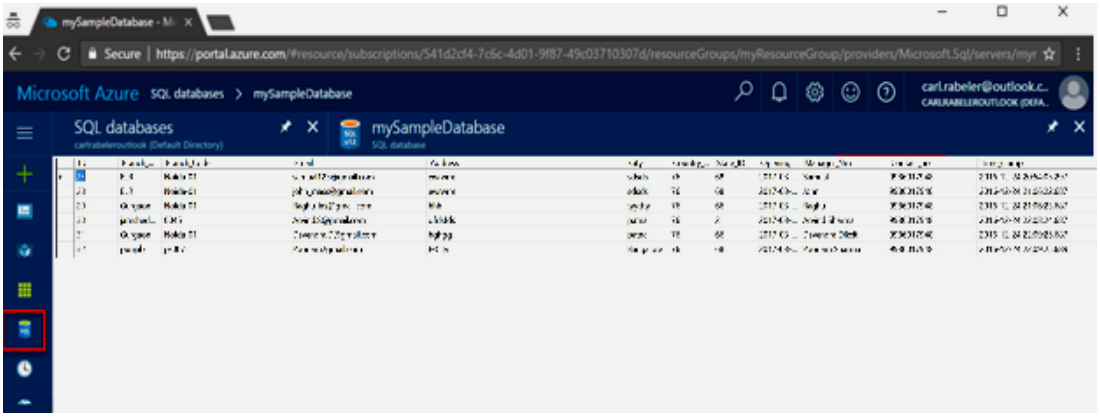

REPEAT THE SAME STEPS AFTER ONE HOUR

Case 2: Local Database table data



After invoked Sql agent check window azure database table. Updated record is now inserted to cloud database.




## CONCLUSION AND FUTURE WORK

The objective of the research is to provide an algorithm to solve the problem that when all clients are reliant on a single server or local database. Data synchronization between local database and cloud database makes data accessible across the world but this research has limitation that it will sink data from local database to cloud database at scheduled time. We have tested these algorithms with SQL server database but this algorithm can be fit to other relational database like Oracle, PostgreSQL, MySQL etc. In the future, researcher solved the problem of data synchronization from local database to cloud database at real time. And also researcher will solve the problem of data synchronization between local–non relational database and cloud non-relational database.

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