

Design Considerations and Application of Central Reference Database in Implementing Automatic Mobile Number Portability Scheme

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ABSTRACT

A database is a structured body of related information. The work showed a design of a Central Reference Database, CR-DB, which should satisfy the need in an automatic mobile number portability scheme. The most significant aspect of a database design is planning. Data integrity in database design seeks to minimize data redundancy without loss of data. There is need to avoid anomalies such as insertion, deletion and update anomalies. In this work, structural query language, SQL, is used as the relational database management system, RDBMS, while phpMyAdmin is used as the administrative in-house database software. The database design of schema diagrams with large numbers of empty attributes regarded as null values. The work covers database concept and terminology, database design principles as well as normalization and normal forms designs. The end result is the modeling of entities and relationships. The schema shows a one-to-one, one-to many (many-to-one) and many to many relationships in the arrangement of primary and foreign keys. Considering the novelty of this work, it is considered by the authors to be a major milestone in wireless and cellular telecommunications industry.

Keywords: Automatic Mobile Number Portability (AMNP), Central Reference Database (CR-DB), Structural Query Language (SQL), dB Schema, Entity Relationship

1. Introduction

A database is described as an electronic system capable of allowing data to be easily retrieved, manipulated, and reorganized with a view to updating it. In other words, an organization uses a database as a method of storing, managing, and retrieving information. A database management system (DBMS) is used to manage modern databases. Data management is the process of ingesting, storing, organizing, and maintaining the collected and created data by an organization (Stedman and Vaughan, 2020). Knight (2018) posited that data management allows a person to organize, store and retrieve data from a computer. The author went further to add that database management is a term used to describe operations and security practices as carried out by a Database Administrator throughout a data life cycle. The direct result of data management, the author continued, is the maximization of data value.

It has been observed that a wide range of tasks is usually involved in the process of database management. Considering small and relatively medium-sized organizations with obvious limited resources, multiple roles could be undertaken by individual workers. However, with complex and very large organizations, data management professionals are varied and usually include a wide range of specialists. There are different types of database management systems. These include Hierarchical databases, Network databases, Relational databases, Object-oriented databases, Graph databases, entity-relationship (ER) model databases, Document databases, and NoSQL databases (Panwar, 2021). In Porlier (2020), four examples of database applications were discussed. These include SQL, NoSQL/NewSQL, Excel, and Kohezion. A detailed discussion of these applications is not the subject of this presentation. Heng (2018) writes that with respect to computers, a database is a collection of data and SQL is a database software program that enhances the storing and retrieval of that data as efficiently as possible.

With regard to design consideration, Ethier (2021) leveraged the supremacy of Universally Unique Identifiers (UUIDs) to guarantee interoperability with micro-services or external applications to demonstrate how it relates to database design. According to Geekflare Editorial (2021), database design is one aspect of a relational database management system (DBMS) that has a very big impact and also plays the most role in the performance of any application. Continuing, the editorial posits that a good database design should be capable of improving data performance. It should also maintain data consistency, accuracy, and reliability while at the same time eliminating redundancies by reducing storage space. All these could be achieved with a good and well-structured entity-relationship diagram (ERD) for easy understanding and application. ERD is a fundamental tool of database design. Three levels of visualization and ERD designs are applied. These are conceptual, logical, and physical. While the conceptual design shows a much-summarized diagram, the details of the entities and their relationships are shown in the logical design though in a database-agnostic format.

In order to design databases from ERDs, many tools could be used. Among the most result-oriented ones are DbSchema, SqIDBM, and Vertabelo. In this presentation, DbSchema was the choice. DbSchema allows SQL, NoSQL, or Cloud databases to be visually designed and managed. In the words of Kopecky (2020), a **database schema** is an abstract design that represents data stored in a database. It holds no data itself, but instead describes the shape of the data and shows how it might relate to other tables or models. In this work, relational databases are used to actualize the CR-DB design for the application in an automatic mobile number portability scheme as conceptualized, designed, and presented.

A Central Reference Database (CR-DB) is a database warehouse of all ported numbers in an Automatic Mobile Number Portability (AMNP) scheme, containing all relevant information relating to such numbers. It is a mirror or fallback database of the information contained in the different databases of the different originating networks participating in the AMNP scheme. This database is conceived to reside in the switching network of the AMNP providers which are the Communication Authority (CA) of a providing country. Using Nigeria as a case study, the CA is the Nigerian Communication Commission (NCC). The CA maintains, oversees, and manages the CR-DB. The main function of this CR-DB is to maintain as a matter of mandate, the data integrity of the records supplied to it by the various Network Operators. The database is designed to store only all current, working, ported-in and ported-out numbers with their relevant and corresponding information. It is not meant to contain records of any number(s) that have never been ported.

Several reasons gave rise to the need for the design and maintenance of the CR-DB. These are outlined as follows.

- 1. To store the information to be exchanged among network operators;
- 2. To maintain and ensure the data integrity of individual network operator's number porting records;

- 3. To ease the process of regular updating and auditing;
- 4. To reconcile and resolve any data discrepancies among network operators;

To provide a backup fallback for recovery in case of any disaster, should the need arise;

To provide easy access to data, information, and call records by the CA for proper monitoring, supervision, and control.

All these concepts are borne in mind as the design of the CR-DB is undertaken in this work.

2. Review of Related Literature

Empirical Review

Some earlier related works by eminent scholars in this field were reviewed and presented for a deeper application understanding.

In the work, "What is MySQL? What is a Database? What is SQL? Definitions of MySQL, SQL, and Database for New Webmasters," Christopher Heng (2018) wrote from the point of view of a webmaster to potential or webmasters who suddenly get confronted by cryptic terms like "MySQL database" or "PostgreSQL database" and the like. According to him, a database is just a collection of data. SQL is a structured query language that makes it easy for data to be accessed through a computer program. MySQL and PostgreSQL are among the many databases that support the use of SQL to access their data. Thus, MySQL is just one of the brands of database software. Learning how to write codes in MySQL was not recommended in the work as a prerequisite to using the software. This was the high point of the paper through the author did not dissuade programmers from acquiring experience in it.

In four Examples of Database Application, Porlier (2019), described a database as a gathering of information, called data and stored on a server. The data is usually organized in such a way that it can be retrieved easily, managed, and edited in significant ways by the end-user. The work covered database software such as SQL, NoSQL/NewSQL, Excel, and Koheziononline database software. The pros and cons of these databases were also presented to show their relevance in database management and administration. The work discussed all about databases, database management systems, and languages.

Steve Lehr (2018), in "The Benefits of Using Database Management Systems," gave seven benefits of using Database Management Systems. These include improved data sharing and data security, effective data integration, consistent data that complies with regulations, a better framework for the enforcement of data privacy and security policies, an increase in productivity of the end-user, and quick decision making. All these formed the bases for the current CR-DB design. Even though it gave no procedural methodology, the work is insightful to the current effort of designing a CR-DB as carried out in this work.

Nwaogwugwu and Amachundi (2021) in the Implementation of a Centralized Reference Database for GSM Service Providers in Nigeria observed that although the advent of Global System for Mobile communication also known as GSM in Nigeria has provided effective telecommunication services, many societal ills came along with it. According to the authors, there is a need for a centralized referenced database for all the GSM operators in the country to stem the tide of security challenges resulting from the use of GSM services. The authors opined that individual operator's databases have not been efficient enough in providing access points capable of allowing security and regulatory bodies to monitor in real-time, the activities of suspicious users. While the implementation was done using HTML, CSS, PHP, and MYSQL database technologies, Object-Oriented System Analysis and Design Methodology (OOSADM) was used for the analysis. However, while their work dwelt on societal consideration, it did not consider technical inputs required in the implementation of AMNP as being presented in this work.

These reviews as reproduced are meant to chart a course of direction in carrying out the present exercise as conceived and implemented.

3. Methodology

Design Considerations of CR-DB

The following considerations are the basis for the design of the CR-DB.

- 1. What nature of information and data are to be stored in the database.
- 2. What are the categories of these data and information?
- 3. How are the data and information to be maintained?
- 4. What entity relationships exist between the database contents?
- 5. Who has the controlling authority regarding the addition and retrieval of the database contents?
- 6. Are the contents of the database to be incremented automatically or based on set conditions?

These considerations are meant to be the bedrock of the design process. As a prelude to this design, Microsoft (MS) Access was used to determine data fields, address tables, numeric and alphanumeric characters. The procedure undertaken in carrying out this objective involved creating relevant fields and tables and querying the table created. This helped in defining parameters, fields, and addresses and retrieving data from the table to the database. This helped in defining parameters, fields, and addresses and retrieving data from the table to the database. The foundation of any database is table creation.

Design Procedure

The procedure for the design framework of the database for use in the automatic mobile number portability scheme is discussed under the following steps.

Step 1: In designing the database, Microsoft Office Access was used first in order to define fields, characters, numerals, alpha numerals, wild cards, and other relevant data details that would make up the contents of the CR-DB design. The various fragments of information contained in the database are those information, and biodata normally supplied by subscribers when requesting porting services. The pieces of information contained in the forms are specified and retrieved when required.

Step 2: In designing the CR-DB, tables containing phone numbers, subscriber's information/biodata, donor and receiving networks would be created. This database is meant to contain all ported numbers from the networks participating in the automatic mobile portability scheme. This table contains personal information as contained in the Central Reference Database and serves as the information hub of the AMNP.

Step 3: This step involves the creation of a table of call logs where call information is maintained. All information such as call sources, call destinations, call duration, total cost, and similar details are maintained in this table.

Step 4: Another table was also created for routing log information. Routing information involving both a ported number call party as well as the receiving party will be stored here. All routing information would be maintained in this table, being a part of the CR-DB.

Design Tools and Applications

The tools used and how they are applied in this design are discussed in this section. This explains the practical application of steps 1 to 4 as used in creating the database tables.

1. phpMyAdmin was accessed

A new browser window was opened and phpMyAdmin entered in the address field "https://localhost/phpmyadmin/"

To always interact and view the database through a web browser, a tool named phpMyAdmin which is a web app, written in PHP language is utilized.

2. Log in to phpMyAdmin

After accessing the phpMyAdmin interface, username and password were typed on the login screen that was presented

3. Creation of Database using phpMyAdmin

The database was created in phpMyAdmin by clicking on 'Databases' and the name of the database 'Automatic Mobile Number Portability was entered in the form and submitted with the 'Create' button.

4. Creation of the Database Tables using fields modeled in Access.

Tables are created as the foundation of the database using the fields modeled in the Microsoft Access Database Management System (MADBMS). A table comprises a set of columns and rows. Each field is given a unique name different from others. A column is known as a field. A single category is represented by each field. The following steps are involved in creating the routing log. The database name "automatic_mobile_number_portability" would be clicked in the left-hand column, and a "Create table" form would be presented. This form would be used to add all the information for the table's columns.

To create a routing log table, "routing log" was entered as the table's name and a number representing "Number of columns" was equally entered. "Go" was then clicked.

To Define the Different Data to be stored in the Table

In that form, under the "Table name," a grid with the first two columns labeled "Name" and "Type" could be seen. The "Name" was for column's name, while the "Type" was for types of data such as;

- I. Id as Name with Data type as INT representing integer number type with length 11
- II. Customer ID with Data type as INT representing integer number type with length 11
- III. Originating network with Data type as TEXT representing text data
- IV. Destination network with Data type as TEXT representing text data
- V. Completing network with Data type as TEXT representing text data
- VI. Time updated with Data type as TIMESTAMP representing date data type for updating dates of the entries with exact system date without requesting user input.

Defining Data Type

In phpMyAdmin, data types were used to specify the category of data for each field captured. A field with text data type was used to store numbers and alphabetic characters. Addresses, names, and other comparatively short texts would be stored here. This field can accumulate up to 255 characters. After the field was used for the creation of the table, data was now entered in each of the fields. Data type was assigned to the fields by phpMyAdmin based on the entries made. The summary of the fields and their entries are shown in table 1.

Table 3.1 Summary of the Fields and their Entries for	or Database Creation using phpMyAdmin
-------------------------------------------------------	---------------------------------------

Data Types		
Data Type	Use	Notes
Text	Alphanumeric data. This was used for texts such as addresses, names, and short pieces of texts. It was equally used for numbers that are not used in mathematical calculations. Up to 255 characters can be stored here.	-
Varchar	This was used in creating fields that will contain texts like names, it is capable of storing as much as 65,535 characters.	This will store information depending on the specific string entered in the database.
Int	Numeric data. This was used in creating numeric data. These numbers are used in mathematical calculations. It can store as much as 11 characters.	
Date/Time	Used for creation of dates and time fields. Timestamp under Date and Time category was used most of the time in the work for accuracy of logs with respect to when information is stored in the database.	Timestamp data type stores date and time information on update of any record.

Definition of the Tables' Columns Data Type

To create the names of columns, various names were entered into the text boxes which are located at the leftmost column under the "Name" header. Later on, the types of data to be stored were defined by going through every single column one after the other.

Id

The "id" was used to identify every record in a table. In every field in a table, no two records are made to have the same value just as shown in the "personal data" table. An example is in table 3.2.

Last Name	First Names	Other Names	City	
Onuigbo	Chika	Martha	Enugu	
Onuigbo	Chika	Martha	Enugu	

Table 3.2 Table without "id"

Every table is made to have an id that stores unique number to every record in the table. The id is designed to be an auto-incrementing integer. This was made in such a way that an id value would be assigned automatically to every new record. The id starts with one (1) and the other subsequent record obtains an id value that is greater than the preceding records by one. In the situations mentioned above, the id field which is the primary key was used to make each record unique. Since the id field assigns id automatically, the "personal data" table now looks like the one in table 3.3.

Table 3.3: Table with "Id"

Id	Last Name	First Name	Other Names	City
1	Onuigbo	Chika	Martha	Enugu
2	Onuigbo	Chika	Martha	Enugu

As an example, that the id value of the first record is 1, the second 2, and so on. This is to make sure that every record has its own unique id value for easy identification and retrieval of the record.

For the first column, from the "Index" column, INT was selected. From the "Type" dropdown menu, at the right "PRIMARY" was also chosen, the check box in the checkbox checked in the "A_I" column.

INT represents integer while PRIMARY shows that it is the primary key. The primary key was the unique value that was used to identify each record. In the design, "A_I" stands for auto-increment. This instructs the database to automatically assign an id value that is higher by one any time a new record was added to the previous records. This id column functions the same for every database table.

Adding data to the database

Having created the database and tables in phpMyAdmin, information was added to the database using HTML forms from the web-based software for automatic mobile number portability. The web-based software was designed with php scripting language and validated with java scripts to ensure that the requirement for the database is met before inserting data or updating already existing data in the database. The HTML forms contain the corresponding fields for a table or more tables in the case where a form is supposed to submit entries. Php scripting language ensures that there was a connection between the database and the web-based forms for insertion and updating of the database tables.

Retrieving Data from the Database by Running a Query

Records were retrieved using a query. This is done by Clicking the "SQL" button at the top of the screen, a large input box appears where the SQL code was entered. The "personal data" was retrieved by selecting the code stated below and clicking the "Go" button.

SELECT * FROM "routing log",

Finally, the database then "selects (all information) from ("personal data") table.

Retrieving Data from the Database by HTML Reports

Records were retrieved using HTML reports in the web-based software that serves as a front-end of the database. The web-based report showed the exact data in the database formatted in striking datasheet reports. Retrieving data from the database in HTML forms is much easier than using the SQL language which requires writing codes. The data in the database (backend) were accessed using the PHP/HTML reports.

4. Data Presentation and Analysis

Results of Designed Tables, Their Uses, Relationships, and Appearances

In the customer personal information form, the following fields were created under the different headings:

Field Name **Customer ID** Surname **Other Names** Address Street Area L.G.A State E-mail **Contact No.** State of Origin **Customer LGA Mother Maiden Name** Photo ID card Type of ID ID No Date of Birth Location

Each of the above fields has data type, description, and a field property which also contained the field size. The outlook of the form generated from the customer's personal information is shown in Figure 1.

The customer mobile ported form was also produced. This contained the following headings:

Mobile Number	
Current Operator	
SIM Serial	
Current Account	
New Account	
Time validated	

The above data in Field Name have their corresponding data type, description, and field properties. The form design is shown in Figure 2.

Finally, the customer declaration form was also designed. In that form, the customer affirms the rightful ownership of the information given in the two earlier forms. The following fields were contained in the form:

Customer ID	
Current Subscriber	
oss of Current Mailbox	
Acceptance of New Service	
oss of configuration	
IM Registration with donor	
Debt recovery	
oss of pre-paid credit	
oss of post-paid credit	
Payments and the second s	
Acceptance	
Customer signature	
Customer thumbprint	
Date of Declaration	

This information is also described under description and field properties. The details of all these are shown in figure 2.

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Customer Personal Informati ADDRESS	Short Text	ADDRESS OF CUSTOMER'S RESIDENCE					
Customer Mobile Porting STREET	Short Text	STREET OF THE ADDRESS OF THE CUSTOMER					
Customer Mobile Porting Nu AREA	Short Text	AREA OF CUSTOMER'S RESIDENCE					
LGA	Short Text	LGA OF THE CUSTOMER'S ADDRESS					
STATE	Short Text	STATE OF THE CUSTOMER'S ADDRESS					
CUSTOMER DECLARATION	Short Text	EMAIL OF THE CUSTOMER IF APPLICABLE					
CUSTOMER DECLARATION : T CONTACT NO	Short Text	ALTERNATE CONTACT NUMBER OF THE CUSTOMER					
CUSTOMER DECLARATION F STATE OF ORIGIN	Short Text	CUSTOMER'S STATE OF ORIGIN					
CUSTOMER LGA	Short Text	LGA OF CUSTOMER					
MOTHER MAIDEN NAME	Short Text	CUSTOMER'S MOTHER'S MAIDEN NAME					
PHOTO ID	OLE Object	PHOTO ID OF CUSTOMER					
TYPE OF ID	Short Text	TYPE OF PHOTO ID					
ID NUMER	Short Text	CUSTOMER'S PHOTO ID NUMBER					
DATE OF BIRTH	Date/Time	CUSTOMER'S DATE OF BIRTH					
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Figure 1a Customer's Personal Forms Display I

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Figure 1b Customer's Personal Forms Display II

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Figure 1: Customer's Personal Forms

As presented in Figure 1, the data fields as is the case in real-time situations are shown. The details are analyzed in Section 4 of this paper. After this, the customer's mobile porting number information forms as shown in Figure2were designed.

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Figure 2: Customer's mobile porting number information forms

Figure 2 contains the customer's mobile ported number information which includes all routing numbers as assigned to every subscriber that is initiating a call process. This process is further analyzed in chapter four of this thesis.

Customer's declaration details as it concerns mobile porting was also designed. This is shown in Figure 3.

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ſ	CUSTOMER DECLARATION				x				
1	Field Name	Data Type	Description (Optional)						
	CURRENT SUBSCRIBER	Short Text	CUSTOMER DECLARES THAT THEY ARE THE OWNER OF THE MOBILE NUMBER						
	LOSS OF CURRENT MAILE	BOX Short Text	DECLARATION OF POSSIBLE LOSS OF VOICE, SMS AND MMS FROM DONOR ACCOUNT						
	ACCEPTANCE OF NEW SE	RVICE Short Text	DECLARATION TO ACCEPT NEW OPERATOR SERVICES						
	LOSS OF CONFIGURATIO	N Short Text DECLARATION OF LOSS OF CONFIGURATIONS IN DONOR ACCOUNT							
	SIM REGISTRATION WITH	DON(Short Text	DECLARATION THAT THE SIM WAS DULY REGISTERED WITH THE DONOR OPERATOR						
	DEBT RECOVERY	Short Text	DECLARATION TO PAY ALL OUTSTANDING MOBILE MONEY ACCOUNT BALANCE WIT	TH THE DONOR OPERATOR					
	LOSS OF PREPAID CREDIT	Short Text	DECLARATION OF LOSS OF UNUSED PREPAY CREDIT WITH THE DONOR OPERATOR						
81	LOSS OF POSTPAID CRED	IT Short Text	DECLARATION OF TERMINATION OF ALL SERVICES WITHOUT REFUND FROM DONO	R OPERATOR FOR POSTPAID					
	PAYMENTS	Short Text	DECLARATION OF CONTINUED PAYMENT OF SUBSCRIBTION AND CALL CHARGES TO	THE DONOR UNTIL THE ACCOUNT IS CLOS					
	ACCEPTANCE	Short Text	CUSTOMER'S ACCEPTANCE OF TERMS AND CONDITION STATED ABOVE.						
-	CUSTOMER SIGNATURE	OLE Object	CUSTOMER'S SIGNATURE						
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CUSTOMER DECLARATION

I AM THE CURRENT SUBSCRIBER OF THE NUMBER TO BE PORTED	● YES O NO
I UNDERSTAND THAT ALL MESSAGES IN THE EXISTING VOICE MAILBOX(ES) AND ANY UNDELIVERED SMS AND MMS	●yes O no
MESSAGES MAY BE LOST	
I UNDERSTAND THAT THE NEW SERVICES AVAILABLE FOR THE RECIPIENT OPERATOR	●yes O no
WILL DEPEND ON THE SERVICES AVAILABLE IN THE PACKAGE OPTION I SUBSCRIBED TO WITH THE RECIPIENT OPERATOR	
ANY CONFIGURATION INFORMATION FROM ANY EXIXTING	● yes O no
ACCOUNT.	
I CONFIRM THAT MY EXISTING SIM/NUMBER(S) HAS BEEN	● yes O no
I UNDERSTAND THAT I WILL BE RESPONSIBLE FOR RECOVERING	● yes O no
ALL OUTSTANDING MONEY ACCOUNT BALANCES	

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Figure 3: Customer declaration forms as detailed in the Access Point outline.

The different forms as shown in Figures 1, 2, and 3 were first designed after the Access Point outline so that all necessary information needed for the eventual configuration and other designs were available and handy.

Database Creation using PHP MySQL software.

Step 1

In designing the database, Microsoft Office Access was used first as shown above to define fields, characters, numerals, alpha numerals, wild cards, and other relevant data that would make up the contents of the CR-DB design. The various fragments of information contained in the database are those information and biodata normally supplied by subscribers when requesting for porting facility. Each of the participating networks in the AMNP scheme has their respective customized porting forms which subscribers are required to complete. The pieces of information contained in the forms are stored and retrieved when required. The unified forms of the participating networks are deemed to be developed in this research. These are adapted from different forms already in use by these networks and were harmonized as shown to underscore their similarities and possible differences.

Step 2

In designing the CR-DB, tables containing phone numbers, subscriber's information/biodata, donor and receiving networks were created. This database is meant to contain all ported numbers from the participating networks in the scheme. The screenshot showing customer personal information table structural design as contained in the Central Reference Database (CR-DB) is shown in Figure 4. This table contains personal information as contained in the Central Reference and serves as the information hub of the MNP.

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Figure 4: Customer personal information table structural design Screenshot

Step 3

This step involved the creation of a table of call logs where call information is maintained. All information such as call source, call destinations, call duration, total cost, and similar details are maintained in this table. The screenshot of the design structure of the Call logs information table is shown in Figure 5.

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Figure 5: Porting Logs Information table structural design Screenshot.

Step 4

Another table was also created for routing log information, the structural design screenshot is shown in Figure 6. Routing information involving both a ported number call party as well as the receiving party will be stored here. All routing information would be maintained in this table, being a part of the CR-DB.

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Figure 6: CR-DB Routing logs table structural design Screenshot

The results of the combined activities from steps 1 to 4 were maintained for subsequent retrieval from the central Reference Database as the need arises.

4. Summary of CR-DB Design – Schema Diagram

The design of the CR-DB carried out in this work is summarized in a single format which shows all the different tables as well as the Maintenance Agent. This is the Database Schema diagram. It is meant to show the different tables and their communication paths with each other in an entity-relationship diagram. From the designed central reference database, the maintenance agent foresees the operation, administrations, and maintenance of all the timed activities of the CR-DB. It generates and assigns Routing Numbers to the CR-DB in blocks for use by the ported numbers in relation to their priority networks. Figure 7 shows the Schema diagram of the CR-DB and the MA. A clearer explanation of this is better understood using a table outlining the foreign and primary keys in the database. This table clearly shows the path relationships between the different tables in the schema. Table 4 shows this relationship.



Figure 7: Schema Diagram for the CR-DB and the MA

As shown in Figure 7 and collaborated in table 4.1, MA was synchronized to the CR-DB to ensure the actualization of the maintenance tasks assigned to it. The synchronization aspect of the MA ensures that all network Operators deploy a common interface standard for their database. However, the common interface standard harmonized several variants so as to retain sufficient control and flexibility over their network implementation. Table 4 shows the Primary and Foreign Keys on the Schema diagram thus outlining the possible relationships between the tables that make up the schema diagram. The relationship also shows how the MA database relates with the CR-DB and other tables in the schema diagram.

Table	Primary keys	Foreign keys							
Automatic mobile number portability database									
Network providers	ID	NONE							
Ported number logs	ID	Mobile number, originating network destination network							
Cost	ID	Call-ID							
Ported numbers	Mobile number	Customer ID, current network							
Customer personal information	Customer ID	None							
Maintenance Agent Database All call query routing code scheme	Routing code	Customer ID, mobile number,							
		originating network							
Customer personal information	None	Customer ID							
Routine log	Id	Customer ID							
		mobile number							
		originating network							
		destination network							
		completing network							
Routing number	Routing number range	None							

Table 4.1 Primary Keys and Foreign keys in the Database

5. Conclusion

In this work, the design considerations, use, and application of the central reference database, CR-DB, in implementing the AMNP scheme have been presented. There has been a clear responsibility of the CR-DB in ensuring this new scheme meets its expectation of improving communication standards among the networks. It is obvious it has the capacity to accommodate the enormity of possible subscribers expected at the birth of the scheme. While the CR-DB is expected to ensure continuous and reliable data integrity, the MA is also expected to assume a high level of credibility. This is in ensuring adherence to stated standards at all times among the participating networks in the scheme. There may be room for improvement in the area of emerging developments in DBMS software packages.

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