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# Fantastic Mobiles Database Model

Version 2.0

**INFO 6210 DATA MANAGEMENT AND DATABASE DESIGN**

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## Revision History

Date	Version	Description	Author
11/08/2016	1.0	Initial draft	Shantam Gupta, Vaishali Lambe, Yuxin Zhang, Zhiyi Wang
17/08/2016	2.0	Added more specifications to the entities and attributes Added high level design	Shantam Gupta, Vaishali Lambe, Yuxin Zhang, Zhiyi Wang

## Introduction

The Database Model for Fantastic Mobile is a representation of a small scale Cellular Company database model. This model contains information about the services provided by the company with a special focus of the tracking mechanism to regulate the services

This model is used as a tool to understand the design and development of a database system created for a small scale Cellular Company. It also helps to understand the flow and storage of information within the database system.

This document covers the following:

- Assumptions used for creating this model
- Description of Entities and attributes
- The mapping of attributes and entities
- Primary, Unique and Foreign key constraints
- High Level Image of the model

The model has been created by Shantam Gupta, Vaishali Lambe, Yuxin Zhang, Zhiyi Wang for academic purposes under the guidance of Mr. Vincent Lattuada as part of his coursework for **INFO6210 18748 Data Mgt and Database Design SEC 09 - Fall 2016** at Northeastern University.

## Table of Contents

Revision History.....	1
List of Tables .....	4
List of Figures.....	5
Scope.....	6
IN SCOPE: .....	7
OUT OF SCOPE: .....	9
High Level Design: .....	11
Relations:.....	12
Entities & Attributes.....	13
Glossary.....	31
References.....	32

# List of Tables

Customer.....14

Phone.....15

SIM Card.....16

Contract.....17

Text.....19

Voice.....21

Data.....23

Bill.....25

Category.....26

Employee.....27

Address.....28

Location.....29

Towers.....30

Signal.....31

List of Figures

High Level Design.....11

## Scope

Scope describes the domain and the design boundaries of the associated database model including the rules and assumption used for designing the model.

This document contains information about the database design for a Cellular Company. Database design includes, in scope and out of scope business requirements.

Also, it has entities like Customers, Location, Equipment, Service, Usage, Contract, Employee and Tower. This document elaborates and defines these entities and attributes associated with.

Though main focus of this Cellular Company database design is, phone usage and contracts/plans, it gives clear picture starting from customers purchasing a phone from a company to its usage, servicing the customers, maintain their records, and generate their bills, network connections too.

## IN SCOPE:

It includes all the details about the rules and assumptions made while designing this model that are present in the model. It helps to determine the inner domain of the model.

Sr.No.	Description
IS01	Each Customer can have more than one connection.
IS02	A Contract cannot exist on its own (without the customer).
IS03	The main focus of the Cellular Company is in providing data/text/voice services.
IS04	Each tower can receive and transmit multiple signals from innumerable devices within its specified range.
IS05	A phone device could change towers for signal transmission.
IS06	A customer can call /send text messages/ browse multiple webpages at the same instant.
IS07	The customer has the flexibility to modify and change its contract.
IS08	There exists a head customer for a family plan type of contract.
IS09	Billing takes into consideration the overshoot in consumption of services provided by the company.
IS10	Only the meta Data for voice/call/ text services are being collected.
IS11	Non sharing plans should be at phone level.
IS12	Tracking of unique identification numbers like IMEI is required for each device.
IS13	Each Customer can have more than one equipment.
IS14	Each Customer can have more than one contract.
IS15	Employee can be a customer at the same time.
IS16	Employee can serve one or more customers.
IS17	Company tracks the customer usage based on service used.
IS18	Bill generated is based on service, usage and contract.
IS19	Discounts are available with plans
IS20	One sim card can be switched from one equipment to another
IS21	The bill generated includes tax associated with the services



<b>IS22</b>	<b>The head of the family plan customer pays the bill of the contract</b>
<b>IS23</b>	<b>Many Bills are generated for each contract for each customer</b>
<b>IS24</b>	<b>One Sim card can only belong to one phone at a particular instance of time</b>
<b>IS25</b>	<b>Each type of contract can have many customers and sim cards associated with it</b>

## OUT OF SCOPE:

It provides details about the assumptions that have been used as a parameter for defining the design boundary for the development of the model. It includes those details which are not present in the model but are necessary to understand the functionality of the model.

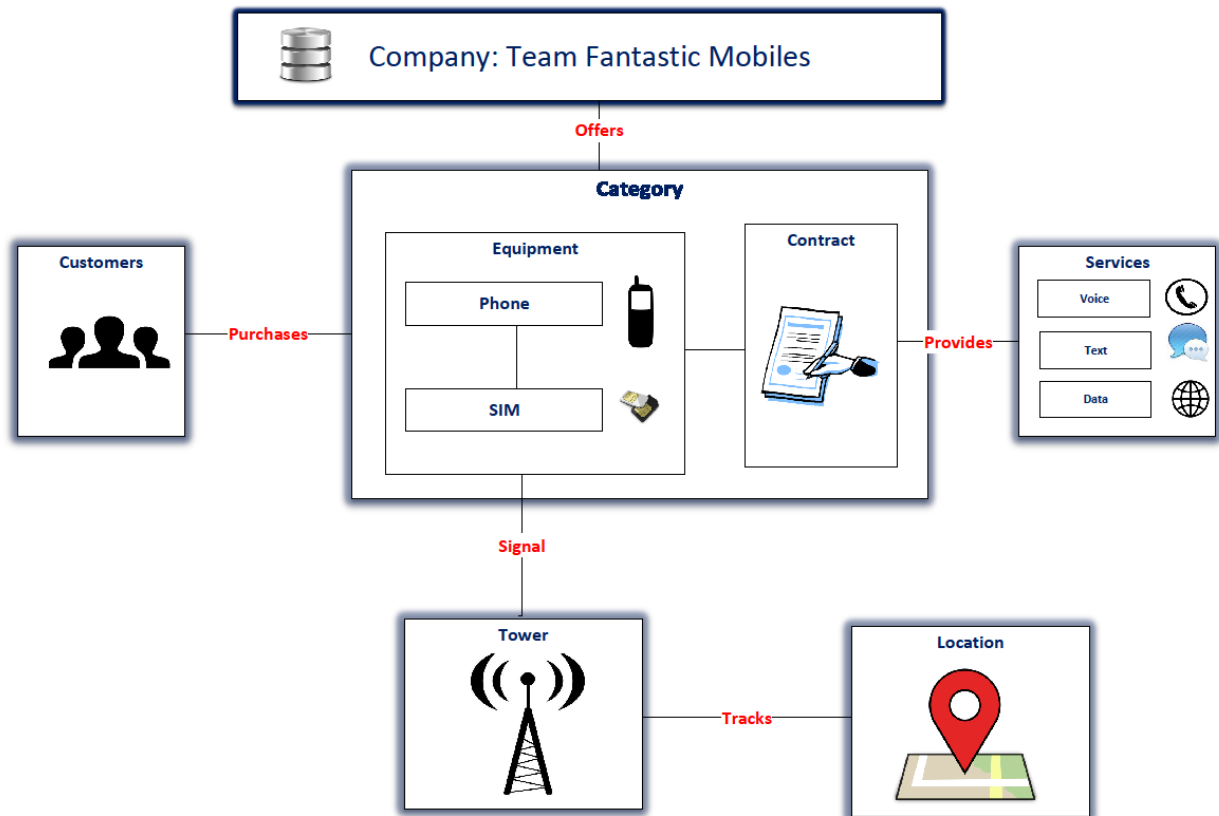
Out-of-scope items contribute to simplify the content of this cellular model and embody the relationship between entities. Consequently, although these items are not included in the model, it is essential to understand them which helps to do a better design.

In this cellular model, out-of-scope items are as following.

Sr. No.	Description
OS01	More than one towers cannot send /receive the same signal at the same instance.
OS02	Customer feedback and other Quality features are beyond the scope of this model.
OS03	Collection of Marketing and Advertisement data is not in the scope of this model.
OS04	In house Manufacturing of products/services is beyond the scope of this model.
OS05	Provision of exceptional plans like international calling are beyond the scope of this model.
OS06	Tracking of malfunctioned equipment(s) is out of scope.
OS07	Postpaid Services are not incorporated in the design of the model.
OS08	The content of the data services consumed by a customer is not being collected.
OS09	There cannot be two or more heads in family plan like contract
OS10	The locking of customer accounts because of overshoot of stipulated contract limits is not captured by the model
OS11	Detail supplier info like supplier credibility is not captured in this model
OS12	Detail employee info for company insurance policy use is not required
OS13	Employee family phone/service discounts
OS14	Exchange of contracts is not permissible
OS15	Validation of customers' identity is not done for purchase made by debit/credit card
OS16	Employee payroll system is not included the design
OS17	Sharing of unconsumed services is not permissible

<b>OS18</b>	<b>Tracking of inventory of equipment is out of scope</b>
<b>OS19</b>	<b>Unconsumed services cannot be carry forwarded</b>
<b>OS20</b>	<b>There is no tracing of the end tower in a signal transmission</b>

## High Level Design:



## Relations:

It describes the connection between two entities, and also gives a representation of their association.

Name	Identifying	Parent Entity	Child Entity	Mandatory Child	Mandatory Parent
Customer Phone	FALSE	Customer	Phone	FALSE	FALSE
Sim Cards installed in Phone	FALSE	Phone	SIM Card	FALSE	FALSE
Customer Contract Purchased	TRUE	Customer	Contract	FALSE	TRUE
Text Usage under Contract	FALSE	Contract	Text	FALSE	TRUE
Voice Usage under Contract	FALSE	Contract	Voice	FALSE	TRUE
Data Usage under Contract	FALSE	Contract	Data	FALSE	TRUE
Contract is based on certain SIM Card	TRUE	SIM Card	Contract	FALSE	TRUE
Text Usage passing to Bill	FALSE	Bill	Text	FALSE	FALSE
Voice Usage passing to Bill	FALSE	Bill	Voice	FALSE	FALSE
Data Usage passing to Bill	FALSE	Bill	Data	FALSE	FALSE
Customer using SIM Card	FALSE	Customer	SIM Card	FALSE	FALSE
Contract Phone	FALSE	Phone	Contract	FALSE	FALSE
SIM Connectivity	TRUE	SIM Card	Signal	FALSE	TRUE
Tower Communication	TRUE	Towers	Signal	FALSE	TRUE
Location Flag	FALSE	Location	Towers	FALSE	TRUE
SIM Service Type Flag	FALSE	Category	SIM Card	FALSE	FALSE
Service Type Flag	FALSE	Category	Contract	FALSE	FALSE
Product Type Flag	FALSE	Category	Phone	FALSE	FALSE
Bill Generation required Contract Info	FALSE	Contract	Bill	TRUE	TRUE
Employee work on Contract	FALSE	Employee	Contract	FALSE	FALSE
Employee Address	FALSE	Address	Employee	TRUE	TRUE
Customer Address	FALSE	Address	Customer	TRUE	TRUE

## Entities & Attributes

**Customer:** individuals who make a purchase in this cellphone company.

<u>Customer</u>					
Attribute Name:	Description:	Data Type(size)	Key:	Null or Not Null	Sample Data
CustomerID	Customer ID, the unique numbers and characters to represent each customer	Integer	Primary key	Not Null	001234994, 021568833, 011245664, 035899903
CustomerName	The names of customers	Varchar (20)		Not Null	JAMES GREEN, TOM SMITH, GABY SOLIS, SUSAN MAYER
CustomerEmail	The Email address of customers	Varchar (30)		Not Null	<a href="mailto:James00@gmail.com">James00@gmail.com</a> <a href="mailto:Smith21@gmail.com">Smith21@gmail.com</a> <a href="mailto:Gasol98@gmail.com">Gasol98@gmail.com</a> <a href="mailto:sumay33@gmail.com">sumay33@gmail.com</a>
Phone	The unique number which customer has for his phone	Varchar (11)		Not Null	857-202-7856 857-201-6785 857-203-6688 857-205-5934

**Phone:** the equipment that customers use.

<u>Phone</u>					
Attribute Name:	Description:	Data Type(size)	Key:	Null or Not Null	Sample Data
IMEI	A unique 15 digit IMEI number which can be used to check the information of the device	BigInt	Primary key	Not Null	159328532155345, 458376034895233, 593400857322953, 559321100577392
Maker	The maker of the equipment	Varchar (20)		Not Null	Apple, Samsung
Model	The exact model of the equipment	Varchar (20)		Not Null	iPhone 6s Samsung note 7
Year	When the equipment was made	Integer		Not Null	2016, 2015, 2014
CustomerID	Indicates which customer ID this IMEI related to	Integer	Foreign key		001234994, 021568833, 011245664, 035899903
CategoryID	The set of equipment having common features	Integer	Foreign key		1 2 3 4

**SIM Card:** A Subscriber Identity Module (SIM) card is a portable memory chip used mostly in cell phones that operate on the Global System for Mobile Communications network.

<u><b>Sim Card</b></u>					
<b>Attribute Name:</b>	<b>Description:</b>	<b>Data Type(size)</b>	<b>Key:</b>	<b>Null or Not Null</b>	<b>Sample Data</b>
SimID	Sim ID, the unique numbers to represent each sim card	Integer	Primary key	Not Null	23495538210, 45989366694, 33593789632, 55938420552
PhoneNumber	The phone number of each sim card	Integer		Not Null	617-344-5633, 854-245-6644, 334-767-2278, 615-477-0943
SimSizeType	The exact size of sim card	Char (5)		Not Null	Standard, Micro, Nano
IMEI	Indicates which IMEI this simID related to	BigInt	Foreign key		159328532155345, 458376034895233, 593400857322953, 559321100577392
CustomerID	Indicates which customer ID this IMEI related to	Integer	Foreign key		001234994, 021568833, 011245664, 035899903
CategoryID	The set of equipment having common features	Integer	Foreign key		1 2 3 4



**Contract:** A contract is a voluntary arrangement between two or more parties that is enforceable at law as a binding legal agreement. In this cellular model, customers sign contracts with cellphone company when they purchase plans. Contract includes the type of the contract, the concrete text, voice and data in the contract and the start time and end time of the contract.

<u><b>Contract</b></u>					
<b>Attribute Name:</b>	<b>Description:</b>	<b>Data Type(size)</b>	<b>Key:</b>	<b>Null or Not Null</b>	<b>Sample Data</b>
ContractID	Contract ID, identifies each unique kind of the contract	Integer	Primary key	Not Null	13112293, 13322989, 21322199, 21363278
Type	The certain contract type that customers ordered	Varchar (20)		Not Null	Family Plan, Personal Contract, Pre-Paid
ContractText	Contract Text, the text allowed for the customer based on the certain contract	Integer		Not Null	500,1000,900
ContractVoice	Contract Voice, the voice of minutes allowed for the customer based on the certain contract	Time		Not Null	100,300,500, 1000
ContractData	Contract Data, the data plan in megabyte in the contract	Float		Not Null	1000.23,500.001, 3000.002
StartTime	Start Time, when the contract goes into effect	Time		Not Null	01/13/2016 12/23/2015 03/18/2016
EndTime	End Time, when the contract becomes invalid	Time		Not Null	07/13/2016 06/23/2016 03/18/2017
CustomerID	Indicates which customer this contract belongs to	Integer	Primary Foreign key	Not Null	001234994, 021568833, 011245664, 035899903
SimID	Indicates which SimID this	Integer	Primary Foreign	Not Null	23495538210, 45989366694,

	contract related to		key		33593789632, 55938420552
IMEI	Indicates which IMEI this contract related to	BigInt	Foreign key		159328532155345, 458376034895233, 593400857322953, 559321100577392
CategoryID	Indicates which category this contract belongs to	Integer	Foreign key		1001 1002 1003
EmployeeID	Indicated which employee is responsible for this contract	Integer	Foreign key		122343776 547764388 975313609

**Text:** In this cellular model, text refers to the sending and receiving of text messages by mobile phone. Also, text includes the length of the text, when the text is sent or received and whether the text is sent or received. Each text has its unique textID and can be tracked in database.

<u>Text</u>					
Attribute Name:	Description:	Data Type(size)	Key:	Null or Not Null	Sample Data
TextID	Text ID, the unique numbers and characters to represent each text	Integer	Primary key	Not Null	001228443, 349553422, 007438225, 448742201
TextLength	The length of text content	Integer		Not Null	100,200, 240
TextDate	The exact date when the text was sent	Datetime		Not Null	01/19/2016, 05/15/2016
Sent_Received	Flag used to identify text messages as sent (1)/ received (0)	Bit		Not Null	0, 1
Beta_PhoneNumber	If Sent_Received flag is 1 then Beta_PhoneNumber is a receiver's phone number and if Sent_Received flag is 0 then Beta_PhoneNumber is a sender's phone number	Varchar(11)		Not Null	857-201-7831 857-202-7892 857-203-4564 857-201-2256
CustomerID	Indicates which customer this text belongs to	Integer	Foreign key	Not Null	001234994, 021568833, 011245664, 035899903
ContractID	Indicates which contract this text belongs to	Integer	Foreign key	Not Null	13112293, 13322989, 21322199, 21363278
BillID	Bill ID, Indicated which bill this text related to	Integer	Foreign key		001239292, 013322989, 021322199, 021363278
SimID	Sim ID, indicates	Integer	Foreign	Not Null	23495538210,

	this text is sent from which Sim ID		key		45989366694, 33593789632, 55938420552
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**Voice:** In this cellular model, voice refers to customers using their phones to give or receive a call. Also, voice includes the start date and end date of the voice and whether this voice is sent or received. Each voice is recorded and identified by a unique voice ID. Also, each voice can be track in this database.

<u><b>Voice</b></u>					
<b>Attribute Name:</b>	<b>Description:</b>	<b>Data Type(size)</b>	<b>Key:</b>	<b>Null or Not Null</b>	<b>Sample Data</b>
VoiceID	Voice ID, the unique numbers and characters to represent each voice	Integer	Primary key	Not Null	335873324, 339855325, 998432001, 334500291
VoiceDateStart	The start time of this voice	Datetime		Not Null	02/04/2016 11:00, 02/03/2016 13:45
VoiceDateEnd	The end time when this voice was over	Datetime		Not Null	02/14/2016, 02/03/2016 03/10/2016
Sent_Received	Flag used to identify voice as sent (1)/ received (0)	Bit		Not Null	0, 1
Beta_PhoneNumber	If Sent_Received flag is 1 then Beta_PhoneNumber is a receiver's phone number and if Sent_Received flag is 0 then Beta_PhoneNumber is a sender's phone number	Varchar(11)		Not Null	857-201-7834 857-202-7899 857-203-4563 857-201-2255
CustomerID	Indicates which customer this voice belongs to	Integer	Foreign key	Not Null	001234994, 021568833, 011245664, 035899903
ContractID	Contract ID, indicates which contract this voice belongs to	Integer	Foreign key	Not Null	13112293, 13322989, 21322199, 21363278
BillID	Bill ID, indicated which bill this voice related to	Integer	Foreign key		001239292, 013322989, 021322199, 021363278

SimID	Sim ID, indicates this voice is made from which Sim ID	Integer	Foreign key	Not Null	23495538210, 45989366694, 33593789632, 55938420552

**Data:** In this cellular model, data include the total data in megabyte that customers used for connecting to the Internet and the date when the amount of data is used. Also, the usage of data can be tracked in this database.

<u>Data</u>					
Attribute Name:	Description:	Data Type(size)	Key:	Null or Not Null	Sample Data
DataID	The unique numbers and characters to represent certain data	Integer	Primary key	Not Null	440022345, 339857439, 349853203, 454893845
DataUsed	Data in megabyte that customer used in one day	Float		Not Null	2.0, 150, 400
DataDate	The concrete date when data was used	Datetime		Not Null	01/09/2015 02/15/2016 10/11/2016
CustomerID	Indicates which customer this data belongs to	Integer	Foreign key	Not Null	001234994, 021568833, 011245664, 035899903
ContractID	Indicates which contract this dataused belongs to	Integer	Foreign key	Not Null	13112293, 13322989, 21322199, 21363278
BillID	Bill ID, indicated which bill this data related to	Integer	Foreign key		001239292, 013322989, 021322199, 021363278
SimID	Sim ID, indicates the data is used by which Sim ID	Integer	Foreign key	Not Null	23495538210, 45989366694, 33593789632, 55938420552

**Bill:** In this cellular model, bill includes the status of bill, tax, discount and the total money that the customers need to pay for the usage. Each bill is identified by a bill ID and can be track in this database.

<u>Bill</u>					
Attribute Name:	Description:	Data Type(size)	Key:	Null or Not Null	Sample Data
BillID	Bill ID, identifies each unique bill	Integer	Primary key	Not Null	001239292, 013322989, 021322199, 021363278
Status	Status records whether bill has been paid or not	Varchar (10)		Not Null	Paid, Unpaid
GrossBillTotal	The total bill before tax is included	Money		Not Null	\$29.0, \$36.1, \$40.5
Discount	The discount of GrossBillTotal	Float		Not Null	0 10% 20%
Tax	The total tax based on the GrossBillTotal and region	Money		Not Null	\$5.25 \$3.42 \$4.65
NetBillTotal	the amount bill of tax and GrossBillTotal after discount	Money		Not Null	\$30.75 \$25.68 \$36.87
CustomerID	Customer ID, indicates which customer this bill belongs to	Integer	Foreign key	Not Null	001234994, 021568833, 011245664, 035899903
ContractID	Contract ID, indicates which contract this bill belongs to	Integer	Foreign key	Not Null	13112293, 13322989, 21322199, 21363278
SimID	Sim ID, indicates which Sim ID this bill belongs to	Integer	Foreign key	Not Null	23495538210, 45989366694, 33593789632, 55938420552



**Category:** The products/services type flag to identifies the product/service we sold, which the type could be either phone, SIM card, or contract

<u>Category</u>					
Attribute Name:	Description:	Data Type (size)	Key:	Null or Not Null	Sample Data
CategoryID	Category ID, identifies which SIM card is implementing this signal	Integer	Primary Key	Not Null	131931233, 223292289, 221123199, 632212378
CategoryType	Category Type, which indicates the type of products/services	Varchar (20)		Not Null	Phone, SIM Card, Contract

**Employee:** The entity of record for our company employee's information

<u>Employee</u>					
Attribute Name:	Description:	Data Type (size)	Key:	Null or Not Null	Sample Data
EmployeeID	Employee ID, the number identifies the unique employee in our company	Integer	Primary Key	Not Null	631931233, 632212377, 632212376, 632212375
EmployeeName	Employee Name, the attribute record of employee's name	Varchar (20)		Not Null	Jake Wang, Porter Robinson, Donald Trump, Jeff Sessions
HireDate	Hire Date, the record that when the certain employee started to be hired here	Datetime		Not Null	3/2/16 12:00 AM, 5/2/16 12:00 AM, 5/2/16 12:00 AM, 11/12/16 12:00 AM
EmployeeEmail	Employee Email, the record of each employee email address for contact purpose	Varchar (40)		Not Null	<a href="mailto:bigass@gmail.com">bigass@gmail.com</a> , <a href="mailto:iLoveData@yahoo.com">iLoveData@yahoo.com</a> , <a href="mailto:studymoreuntiltheworldend@qq.com">studymoreuntiltheworldend@qq.com</a> ,
Phone	Employee Phone, the record of employee phone number for	Varchar (11)		Not Null	7653920192, 8839291999, 3092019293, +15762938891

	contact purpose				
AddressID	Address ID, the foreign key which to indicates the employee address	Integer	Foreign Key	Not Null	2938291, 2010293

**Address:** The entity of address record for persons involved with our business activities, which usually including customers and employees.

<u>Address</u>					
Attribute Name:	Description:	Data Type (size)	Key:	Null or Not Null	Sample Data
AddressID	Address ID, identifies unique record of a certain address	Integer	Primary Key	Not Null	2938291, 2010293
StreetAddress	Street Address, record of the specific street address	Varchar (40)		Not Null	107 Gordon St, 103 Boylston St #3, 270 S River Rd, 666 Great Dr
City	City, record of city name for the specific address	Varchar (20)		Not Null	Boston, W Lafayette, Chicago
State	State, record of state name for the specific address	Varchar (20)		Not Null	MA, IN, IL, CA, NJ
Country	Country, record of country name for the specific address	Varchar (20)		Not Null	United States, Canada, Mexico, China, Germany
Zipcode	Zip Code, record of zip code for the specific address	Integer		Not Null	47906, 02134, 29392, 02135

**Location:** The traced place of a tower in the form of latitude and longitude

<u><b>Bill</b></u>					
<b>Attribute Name:</b>	<b>Description:</b>	<b>Data Type(size)</b>	<b>Key:</b>	<b>Null or Not Null</b>	<b>Sample Data</b>
Latitude	The angular distance of a tower north or south of the earth's equator for a tower	Float	Primary key	Not Null	44.25 65.20 45.11 15.26
Longitude	The angular distance of a tower east or west of the meridian	Float	Primary key	Not Null	45.26 16.20 18.45 19.20

**Towers:** A cellular telephone site where antennae and electronic communications equipment are placed on other raised structure, to create a cell (or adjacent cells) in a cellular network.

<u><b>Bill</b></u>					
<b>Attribute Name:</b>	<b>Description:</b>	<b>Data Type(size)</b>	<b>Key:</b>	<b>Null or Not Null</b>	<b>Sample Data</b>
TowerID	The unique number to identify a particular tower	Integer	Primary key	Not Null	1 2 3 4
Latitude	The angular distance of a tower north or south of the earth's equator	Float	Foreign key	Not Null	44.25 65.20 45.11 15.26
Longitude	The angular distance of a tower east or west of the meridian	Float	Foreign key	Not Null	45.26 16.20 18.45 19.20

**Signal:** The entity of signal connection between phone SIM card and signal tower, which indicates the record and connectivity of signal

<u><b>Signal</b></u>					
<b>Attribute Name:</b>	<b>Description:</b>	<b>Data Type (size)</b>	<b>Key:</b>	<b>Null or Not Null</b>	<b>Sample Data</b>
SimID	Sim Card ID, identifies which SIM card is implementing this signal	Integer	PFK	Not Null	131122933, 133229289, 213221199, 213632278
TowerID	Tower ID, identifies which tower is communicating with this signal	Integer	PFK	Not Null	1929283, 1920229, 2020192, 2020192
Frequency	The communicating frequency between tower and sim card, in unit of hertz(HZ)	Big Integer(BigInt)		Not Null	800*10 <sup>6</sup> , 1900*10 <sup>6</sup> , 450*10 <sup>6</sup>
Time	The date and time this signal created	DateTime		Not Null	11-17-2016 4:44p, 05-02-2014 2:30a

## Glossary:

Term	Description/Definition
Primary Key	It is a special relational database table column (or combination of columns) designated to uniquely identify all table records
Foreign Key	It is a field (or collection of fields) in one table that uniquely identifies a row of another table
Primary Foreign Key	The foreign key is defined in a second table, but it refers to the primary key in the first table
Not Null	It is a constraint which enforces a table column to not accept NULL values



## References:

[http://databaseanswers.org/data\\_models/](http://databaseanswers.org/data_models/)

<http://stackoverflow.com/questions/9508564/dataset-or-entity-data-model>

<http://stackoverflow.com/questions/1196415/what-datatype-to-use-when-storing-latitude-and-longitude-data-in-sql-databases>

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