2016

Fantastic Mobiles Database Model

Version 4.0

INFO 6210 DATA MANAGEMENT AND DATABASE DESIGN

●Shantam Gupta ● Vaishali Lambe ● Yuxin Zhang ● Zhiyi Wang

Northeastern University | Team: Fantastic Mobiles

Table of Contents

Revision History

Date	Version	Description	Author
11/08/2016	1.0	Initial modeling of customers, contracts and consumption of text, voice, data services	Shantam Gupta, Vaishali Lambe, Yuxin Zhang, Zhiyi Wang
11/17/2016	2.0	Addition of bill, payment and tracking location of SIM card via tower to the preliminary model	Shantam Gupta, Vaishali Lambe, Yuxin Zhang, Zhiyi Wang
12/05/2016	3.0	Modification of the relationship between customer, employee and address. Rectification of business rules, table of contents and database design model.	Shantam Gupta, Vaishali Lambe, Yuxin Zhang, Zhiyi Wang
12/14/2016	4.0	Modification of text and voice and category entities and the description of each entity. Rectification of relations table and toad model.	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.

Business Rules

Business rules 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 the Cellular Company – Team Fantastic Mobiles.
Database design includes, in scope, out of scope and additional 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	The Cellular Company sells Phone devices and SIM cards
IS02	The main focus of the Cellular Company is in providing data/text/voice services
IS03	The Cellular Company tracks the customer service (text, voice and data) consumption for each type of contract
IS04	A Customer can prefer to purchase more than one phone connection (Sim Card)
IS05	A customer can send/receive text messages to more than one person at same instance
IS06	A customer can call more than one person at same instance
IS07	A customer can browse multiple Webpages at the same instant
IS08	The customer has the flexibility to upgrade its contract
IS09	Each Customer can have more than one phone device
IS10	Each Customer can have more than one contract
IS11	A Contract cannot exist without a customer
IS12	There exists a head customer for a family plan type of contract
IS13	Metadata (duration and phone number of person associated with it) for voice service is being collected
IS14	Metadata (text length, text date and phone number of person associated with it) for text service is being collected
IS15	Metadata (data used, duration) for data service is being collected
IS16	One SIM card can be switched from one equipment to another
IS17	Tracking of unique identification numbers like IMEI is required for each device
IS18	A phone device can receive and transmit signals to/from more than one tower
IS19	Employee can be a customer at the same time
IS20	Employee can serve one or more customers
IS21	Bill is generated based on consumption of services and contract
IS22	The head of the family plan customer pays the bill of the contract

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.

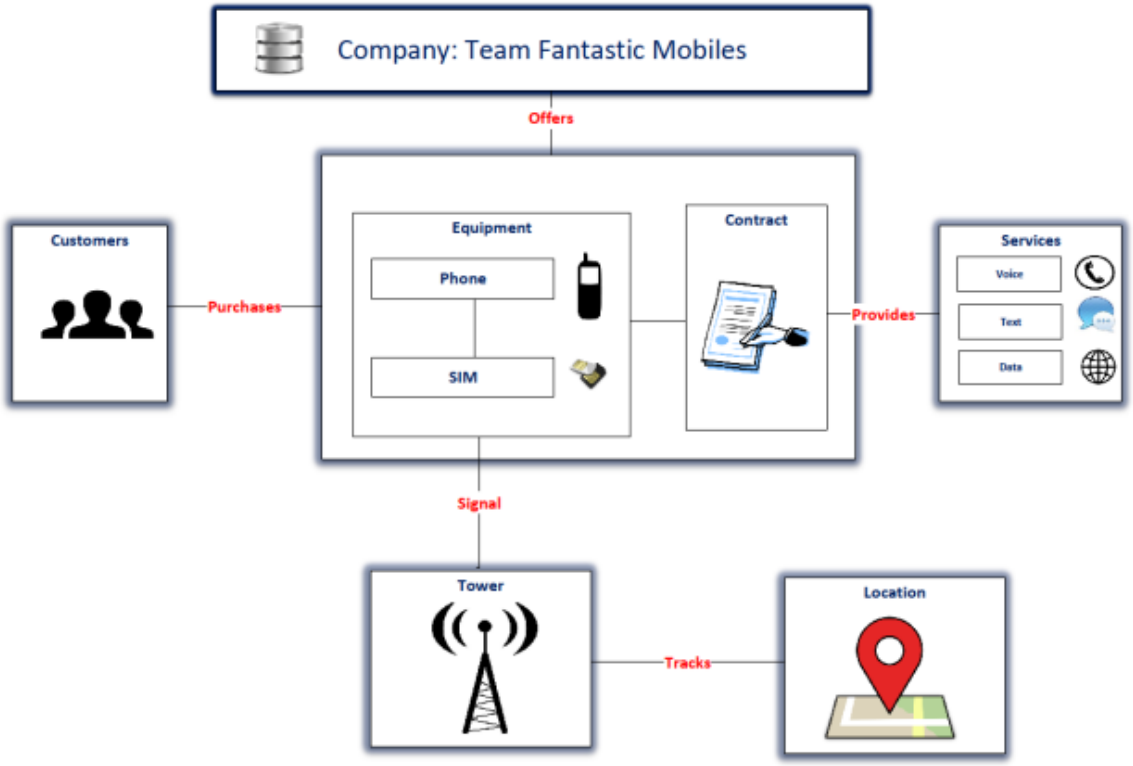
Sr. No.	Description
OS01	More than one towers cannot send /receive the same signal at the same instance
OS02	Customer feedback and other Quality features are beyond the scope of this model
OS03	Collection of Marketing and Advertisement data is not in the scope of this model
OS04	In house Manufacturing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

ADDITIONAL SCOPE

Additional scope includes certain aspects of the database design model which are necessary to define the intricate details of the model but are not covered in in and out of scope.

Sr. No.	Description
AS01	**A phone device could change towers for signal transmission**
AS02	**Each tower can receive and transmit multiple signals from innumerous devices within its specified range**
AS03	**Customer is not bound to purchase a contract, a SIM card and a phone from the company**

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
Description: 1. Customer can choose whether or not to buy phones, so phone entity is optional child. 2. Phone entity represents the product in cellular company inventory, so child entity can exist on its own (without customer).					
Customer Contract Purchased	TRUE	Customer	Contract	FALSE	TRUE
Description: 1. Customer can choose whether or not to purchase contracts from cellular company, so contract entity is optional child. 2. Contract entity cannot exist without customer, so customer entity is mandatory parent.					
Text Usage under Contract	FALSE	Contract	Text	FALSE	TRUE
Description: 1. A contract may or may not include text service, so text entity is optional child. 2. Text entity cannot exist on its own, so contract entity is its mandatory parent.					
Voice Usage under Contract	FALSE	Contract	Voice	FALSE	TRUE
Description: 1. One contract may or may not include voice service, so voice entity is optional child. 2. Voice entity cannot exist on its own, so contract entity is its mandatory parent.					
Data Usage under Contract	FALSE	Contract	Data	FALSE	TRUE
Description: 1. One contract may or may not include data service, so data entity is optional child. 2. Data entity cannot exist on its own, so contract entity is its mandatory parent.					
Contract is based on certain SIM Card	TRUE	SIM Card	Contract	FALSE	TRUE
Description: 1. contract cannot exist without a sim card. 2. sim card may or may not relate to a contract since customer can just purchase a sim card but no contract.					
Text Usage passing to Bill	FALSE	Bill	Text	FALSE	TRUE
Description: 1. Bill may or may not include text usage and one bill can include more than one text usage, however					

one text usage can only be covered by one bill, so it is one-to-many relationship. 2. Text entity will generate bill, so bill entity is its mandatory parent.					
Voice Usage passing to Bill	FALSE	Bill	Voice	FALSE	TRUE
Description: 1. Bill may or may not include voice usage and one bill can include more than one voice usage, however one voice usage can only be covered by one bill, so it is one-to-many relationship. 2. Voice entity will generate bill, so bill entity is its mandatory parent.					
Data Usage passing to Bill	FALSE	Bill	Data	FALSE	TRUE
Description: 1. Bill may or may not include data usage and one bill can include more than one data usage, however one data usage can only be covered by one bill, so it is one-to-many relationship. 2. Data entity will generate bill, so bill entity is its mandatory parent.					
Customer using SIM Card	FALSE	Customer	SIM Card	FALSE	FALSE
Description: 1. Customer can choose whether or not to buy sim cards from cellular company, so the SIM card entity is optional child of customer entity. 2. Sim card entity represents the product in cellular company inventory, so child entity can exist on its own (without customer).					
SIM Connectivity	TRUE	SIM Card	Signal	FALSE	TRUE
Tower Communication	TRUE	Towers	Signal	FALSE	TRUE
Signal Location	TRUE	Location	Signal	FALSE	TRUE
Description: 1. One sim card can be tracked by more than one tower and a tower can track more than one sim card, so it is many-to-many relationship. 2. One sim card can have more than one location, and one location can belong to more than one sim card, so it is many-to-many relationship. 3. The location of sim card can be tracked in signal entity.					
Bill Generation requires Contract Info	FALSE	Contract	Bill	TRUE	TRUE
Description: 1. Many bills can be generated by one contract, so it is one-to-many relationship.					
Employee work on Contract	FALSE	Employee	Contract	FALSE	FALSE
Description: 1. One employee can work on more than one contract. 2. A contract may or may not relate to an employee (considering the condition that customer purchases contract through web), so employee entity is an optional parent.					
Employee-to-Address	TRUE	Employee	Employee_ Address	TRUE	TRUE

Address-to-Employee	TRUE	Address	Employee_ Address	TRUE	TRUE
Description: 1. one address can belong to more than one employee and one employee can have more than one address, it is many-to-many relationship.					
Customer-to-Address	TRUE	Customer	Customer_ Address	TRUE	TRUE
Address-to-Customer	TRUE	Address	Customer_ Address	TRUE	TRUE
Description: 1. one address can belong to more than one customer and one customer can have more than one address, so it is many-to-may relationship.					
Bill-to-Payment	TRUE	Bill	Payment_Bill	TRUE	TRUE
Payment-to-Bill	TRUE	Payment	Payment_Bill	TRUE	TRUE
Description: 1. One payment can contain more than one bill and one bill can be divided into more than one payment, so it is many-to-many relationship.					

Entities & Attributes

Address

Description: The address entity keeps track of addresses of customers and employees associated with our company.

Address					
Attribute Name:	**Description:**	**Data Type (size)**	**Key:**	**Null or Not Null**	**Sample Data**
AddressID	Address ID, the unique identification number used to represent each address	Integer	Primary Key	Not Null	2938291, 2938292, 2938293
StreetAddress	Street Address, record of the specific street address	Varchar (40)		Not Null	107 Gordon St, 103 Boylston St, 270 S River Rd
City	City, record of city name for the specific address	Varchar (20)		Not Null	Boston, W Lafayette, Chicago
State	State, record of state name abbreviated as two alphabets as specified on http://pe.usps.gov/	Char (2)		Not Null	MA, CA, NJ
Country	Country, record of country name for the specific address	Varchar (20)		Not Null	United States, Canada, China,
Zipcode	record of zip code for the specific address	Integer		Not Null	47906, 02134

Bill

Description: 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.

Bill					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
BillID	Bill ID, the unique identification number used to represent each bill	Integer	Primary key	Not Null	995215468, 995215469, 995215470
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, 36, 40
Discount	The discount in percentage applied to Gross Bill Total	Float		Not Null	0.00 0.10 0.20
Tax	The total tax applied on the Gross Bill Total (based on local and federal law)	Money		Not Null	5.2 3.4 4.6
NetBillTotal	the amount of the bill with tax and Gross Bill Total after discount	Money		Not Null	30.7 25.6 36.8
ContractID	Contract ID, indicates which contract this bill belongs to	Integer	Foreign key (to Contract entity)	Not Null	13112293, 13112294, 13112295
CustomerID	Customer ID, indicates which customer this	Integer	Foreign key (to Contract entity)		14324742, 14324743,

	bill belongs to				14324744
SimID	Sim ID, indicates which Sim ID this bill belongs to	Integer	Foreign key (to Contract entity)		8910000000100000000, 8910000000166670000, 8910000000216670000

Contract

Description: 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, the contract entity is a records table which keeps logs of the contracts purchased by customer with a particular connection (Sim card No.) associated with the customer. Also, it gives details of the voice, text and data limits for a particular type of contract.

Contract					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
ContractID	Contract ID, the unique identification number used to represent each contract	Integer	Primary key	Not Null	13112293, 13112294, 13112295
ContractType	The certain contract type that customers ordered	Varchar (20)		Not Null	Family Plan, Personal Contract
ContractText	Contract Text, the text allowed for the customer based on the certain contract	Integer		Not Null	500, 350, 200
ContractVoice	Contract Voice, the voice of minutes allowed for the customer based on the certain contract	Time		Not Null	100:00:00, 80:00:00, 150:00:00
ContractData	Contract Data, the data plan in megabyte in the contract	Float		Not Null	1024.00, 500.00, 1200.00
Flag_Head	Labels a customer as head of the family plan type of contract. Denoted by 1 for the head	Bit		Not Null	0, 1

	0 for other				
StartTime	Start Time, when the contract goes into effect	Date		Not Null	01/13/2016 12/23/2015 03/18/2016
EndTime	End Time, when the contract becomes invalid	Date		Not Null	07/13/2016 06/23/2016 03/18/2017
CustomerID	Indicates which customer this contract belongs to	Integer	Primary Foreign key (to Customer entity)	Not Null	14324742, 14324743, 14324744
SimID	Indicates which SimID this contract related to	Integer	Primary Foreign key (to Sim Card entity)	Not Null	8910000000100000000, 8910000000166670000, 8910000000216670000
EmployeeID	Indicated which employee is responsible for this contract	Integer	Foreign key (to Employee entity)		631931233, 631931234, 631931235

Customer

Description: individuals who make a purchase from the cellular database company or whose information has been recorded in company system via marketing and other means.

Customer					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
CustomerID	Customer ID, the unique identification number used to represent each customer	Integer	Primary key	Not Null	14324742, 14324743, 14324744
Cus_fname	The first names of customers	Varchar (20)		Not Null	James, Tom, Susan
Cus_lname	The last names of customers	Varchar (20)		Not Null	Green, Smith, Solis
CustomerEmail	The Email address of customers	Varchar (30)		Not Null	James00@gmail.com Smith21@gmail.com Gasol98@gmail.com
Phone	The phone number to contact the customer	Varchar (11)		Not Null	19842966111, 18062028142, 15506207293

Customer_Address

Description: One Address can belong to more than one customer. And one customer can have more than one address. Therefore, the relationship between customer and address is many-to-many. And in Customer_Address entity, Address ID and Customer ID is unique in combination to relate each Customer ID to its corresponding Address ID.

Customer_Address					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
AddressID	Address ID, the unique identification number used to represent each address	Integer	Primary foreign key (to Address entity)	Not Null	2938291, 2938292, 2938293
CustomerID	Customer ID, the unique identification number used to represent each customer	Integer	Primary foreign key (to Customer entity)	Not Null	14324742, 14324743, 14324744

Data

Description: In this cellular model, data entity contains the details of data usage by customer. It includes the metadata like DataStartTime, DataEndTime, DataUsed, etc.

Data					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
DataID	Data ID, the unique identification number used to represent each data entity record	Integer	Primary key	Not Null	440022345, 440022346, 440022347
DataUsed	Data in megabyte that customer used in one session	Float		Not Null	150.000, 400.000, 200.000
DataStartTime	The exact date and time when data was started being used	DateTime		Not Null	01/09/2015 12:12:00, 02/12/2016 21:01:09, 12/12/2016 10:00:09
DataEndTime	The exact date and time when data was end used	DateTime		Not Null	05/09/2015 14:34:11, 09/12/2016 22:12:13, 08/07/2016 09:12:33
ContractID	Indicates which contract this data belongs to	Integer	Foreign key (to Contract entity)	Not Null	13112293, 13112294, 13112295
BillID	Bill ID, indicated which bill this data related to	Integer	Foreign key (to Bill entity)		995215468, 995215469, 995215470
CustomerID	Indicates which customer this data belongs to	Integer	Foreign key (to Contract entity)		14324742, 14324743, 14324744
SimID	Sim ID, indicates the data is used by which Sim ID	Integer	Foreign key (to Contract entity)		8910000000166670000, 8910000000216670000, 8910000000266670000

Employee

Description: This entity is a record of our company employee's information.

Employee					
Attribute Name:	**Description:**	**Data Type (size)**	**Key:**	**Null or Not Null**	**Sample Data**
EmployeeID	Employee ID, the unique identification number used to represent each employee	Integer	Primary Key	Not Null	631931233, 631931234, 631931235
Emp_fname	Employee first name, the record of employee's first name	Varchar (20)		Not Null	Amy, Porter, Donald
Emp_lname	Employee last name, the record of employee's last name	Varchar (20)		Not Null	Smith, Robinson, Taylor
HireDate	Hire Date, the date when a certain employee is hired	Datetime		Not Null	03/02/2016 12:00:00, 05/02/2016 10:33:09, 11/12/2016 13:45:33
EmployeeEmail	Employee Email, the record of each employee email address	Varchar (40)		Not Null	bigass@gmail.com, Datavv@yahoo.com, studdl@gmail.com

Phone	Employee Phone, the record of employee phone number	Varchar (11)		Not Null	19862528643, 17505010419, 15244883838

Employee_Address

Description: One employee can have more than one address and one address can belong to more than one employee. Therefore, the relationship between employee and address is many-to-many. And in Employee_Address entity, Address ID and Employee ID is unique in combination to relate each Employee ID to its corresponding Address ID.

Employee_Address					
Attribute Name:	**Description:**	**Data Type (size)**	**Key:**	**Null or Not Null**	**Sample Data**
AddressID	Address ID, the unique identification number used to represent each address	Integer	Primary foreign key (to Address entity)	Not Null	2938335, 2938336, 2938337
EmployeeID	Employee ID, the unique identification number used to represent each employee	Integer	Primary foreign key (to Employee entity)	Not Null	631931233, 631931234, 631931235

Location

Description: This entity contains tracked location of sim cards in the form of latitude and longitude.

Location					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
Latitude	The angular distance of a tower north or south of the earth's equator for a tower	Float	Primary key	Not Null	44.25123, 65.20596, 45.11984
Longitude	The angular distance of a tower east or west of the meridian	Float	Primary key	Not Null	45.26789, 16.20110, 18.45541

Payment

Description: This entity contains details of payment made by customer for bills generated for their purchased contracts.

Payment					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
PaymentID	Payment ID, the unique identification number used to represent each payment	Integer	Primary key	Not Null	2155345, 2155346, 2155347
Payment_Method	Payment method, Indicates what kind of method the customer uses for payment	Varchar (20)		Not Null	Cash, Credit card, Debit card
Payment_Date	Payment date, indicates the exact date and time when the customer makes the payment	Datetime		Not Null	01/01/2016 03:04:12, 12/09/2016 12:13:33, 11/05/2015 13:14:11
Payment_Amount	Payment amount, indicates the total amount paid	Money		Not Null	29.0, 36.1, 40.5

Payment_Bill

Description: One payment can cover more than one bill and one bill can be covered by more than one payment (considering the condition that one bill is paid for installment). Therefore, the relationship between Payment and Bill entity is many-to-many. And in the Payment_Bill entity, Bill ID and Payment ID are unique in combination in order to relate each Bill ID to its corresponding Payment ID.

Payment_Bill					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
BillID	Bill ID, the unique identification number used to represent each bill	Integer	Primary foreign key (to Bill entity)	Not Null	995215468, 995215469, 995215470
PaymentID	Payment ID, the unique identification number used to represent each payment	integer	Primary foreign key (to Payment entity)	Not Null	2155345, 2155346, 2155347

Phone

Description: This entity contains information about the equipment (phone device) that this cellular company sells or are yet to be sold.

Phone					
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	35 780502 398494 2, 35 780502 398495 2, 35 780502 398496 2
Year	When(the exact year) the equipment was made	Integer		Not Null	2016, 2015, 2014
Month	When(the exact month) the equipment was made	Integer		Not Null	12, 11, 08
Maker	The maker of the equipment	Varchar (20)		Not Null	Apple, Samsung, Microsoft
Model	The exact model of the equipment	Varchar (20)		Not Null	iPhone 6s, iPhone 4, Galaxy
CustomerID	Indicates which customer ID this IMEI related to	Integer	Foreign key (to Customer entity)		14324742, 14324743, 14324744

Signal

Description: The entity keeps record of location of sim cards as tracked through signal via towers.

Signal					
Attribute Name:	**Description:**	**Data Type (size)**	**Key:**	**Null or Not Null**	**Sample Data**
SimID	Sim ID, the unique identification number used to represent each Sim card	Integer	Primary foreign key (to Sim Card entity)	Not Null	131122933, 131122934, 131122935
TowerID	Tower ID, the unique identification number used to represent each tower	Integer	Primary foreign key (to Towers entity)	Not Null	1929283, 1929284, 1929285
Latitude	Refers to the latitude coordinates of particular SIM card as directed by a tower	Float	Primary foreign key (to Location entity)	Not Null	45.25345, 67.20678, 45.51112
Longitude	Refers to the longitude coordinates of particular SIM card as directed by a tower	Float	Primary foreign key (to Location entity)	Not Null	32.66112, 67.12334, 56.32876
Frequency	The communicating frequency between tower and sim card,	BigInt		Not Null	800000000, 1900000000, 450000000

	in unit of hertz(HZ)				
Time	The date and time when the signal was tracked	DateTime		Not Null	11/17/2016 16:44:09, 05/02/2014 14:30:12, 11/12/2016 19:30:45

SIM Card

Description: 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. This entity contains information about the equipment (sim card) that this cellular company sells or are yet to be sold.

Sim Card					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
SimID	Sim ID, the unique identification number used to represent each Sim card	Integer	Primary key	Not Null	8910000000100000000, 8910000000110000000, 8910000000166670000
PhoneNumber	The phone number associated with each sim card	Varchar(11)		Not Null	19842966111, 18062028142, 15506207293
SimSizeType	The exact size of sim card	Char (10)		Not Null	Micro, Nano
CustomerID	Indicates which customer ID this IMEI related to	Integer	Foreign key (to Customer entity)		14324742, 14324743, 14324744

Text

Description: In this cellular model, text entity keeps track of sent and received text messages by the customers. It includes the length of the text, when the text is sent or received and whether the text is sent or received. Each text record has its unique TextID and can be tracked in database.

Text					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
TextID	Text ID, the unique identification number used to represent each text entity record	Integer	Primary key	Not Null	122844300, 122844301, 122844302
TextLength	The length of characters in a particular text message	Integer		Not Null	100，240, 142
TextDateTime	The exact date and time when the text was sent or received	Datetime		Not Null	01/19/2016 11:12:12, 05/15/2016 21:30:00, 12/12/2016 07:08:19
Sent_Recieved	Flag used to identify text messages as sent (1)/ received (0)	Bit		Not Null	0, 1
Beta_PhoneNumber	The phone number to which a customer sends or received a text from	Varchar(11)		Not Null	14817657288, 15979471989, 11258087209
ContractID	Indicates which contract this text belongs to	Integer	Foreign key (to Contract entity)	Not Null	13112293, 13112294, 13112295
BillID	Bill ID, Indicated which bill this text related to	Integer	Foreign key (to Bill entity)		995215468, 995215469, 995215470
CustomerID	Indicates which customer this text belongs to	Integer	Foreign key (to Contract entity)		14324742, 14324743, 14324744
SimID	Sim ID, indicates	Integer	Foreign		8910000000000000000,

	this text is sent from which Sim ID		key (to Contract entity)		8910000000100000000, 8910000000110000000

Towers

Description: A cellular tower is a structure with electronic communications equipment to facilitate a cellular network. The tower entity contains a unique tower id for each tower.

Bill					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
TowerID	Tower ID, the unique identification number used to represent each tower	Integer	Primary key	Not Null	1, 2, 3

Voice

Description: In this cellular model, voice entity keeps track of sent and received voice call by the customers. It tracks metadata like the datetime of the sent or received voice.

Voice					
Attribute Name:	**Description:**	**Data Type(size)**	**Key:**	**Null or Not Null**	**Sample Data**
VoiceID	Voice ID, the unique identification number used to represent each voice entity record	Integer	Primary key	Not Null	335873324, 335873325, 335873326
VoiceDateStart	The start date and time of a voice call	Datetime		Not Null	02/04/2016 11:00:00, 02/03/2016 13:45:03, 12/11/2015 12:12:11
VoiceDateEnd	The end date and time of a voice call	Datetime		Not Null	02/14/2016 12:11:11, 03/10/2016 11:01:45, 06/07/2016 13:16:11
Sent_Received	Flag used to identify voice as sent (1)/ received (0)	Bit		Not Null	0, 1
Beta_PhoneNumber	The phone number which customer calling to or receiving a call from	Varchar(11)		Not Null	11747926889, 15613894406, 14614418124
ContractID	Contract ID, indicates which contract this voice belongs to	Integer	Foreign key (to Contract entity)	Not Null	13112293, 13112294, 13112295
BillID	Bill ID, indicated which bill this voice related to	Integer	Foreign key (to Bill entity)		995215468, 995215469, 995215470
CustomerID	Indicates which customer this voice record belongs to	Integer	Foreign key (to Contract entity)		14324742, 14324743, 14324744

SimID	Sim ID, indicates the Sim ID associated with this voice call record	Integer	Foreign key (to Contract entity)		8910000000000000000, 8910000000100000000, 8910000000110000000

Glossary

Term	Description/Definition
Beta Phonenumber	It's the phone number that the user's phone receives info from or sends info to
Contract Type	It includes two kinds of contracts: personal contract and family plan. In personal contract, only one person uses the service. In family plan, more than one person share the service
Foreign Key	In the context of relational databases, a foreign key is a field (or collection of fields) in one table that uniquely identifies a row of another table or the same table. In simpler words, the foreign key is defined in a second table, but it refers to the primary key in the first table.
Identifying Relationship	An identifying relationship is when the existence of a row in a child table depends on a row in a parent table. This may be confusing because it's common practice these days to create a pseudo key for a child table, but not make the foreign key to the parent part of the child's primary key.
Many-to-Many Relationship	In systems analysis, a many-to-many relationship is a type of cardinality that refers to the relationship between two entities A and B in which A may contain a parent instance for which there are many children in B and vice versa.
Non-Identifying Relationship	It means the child entity can exist on its own without a parent entity.
Not Null	The not-null constraint is a restriction placed on a column in a relational database table. It enforces the condition that, in that column, every row of data must contain a value - it cannot be left blank during insert or update operations.
One-to-Many Relationship	In relational databases, a one-to-many relationship occurs when a parent record in one table can potentially reference several child records in 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.
Primary Key	A primary key is a special relational database table column (or combination of columns) designated to uniquely identify all table records. A primary key's main features are: It must contain a unique value for each row of data. It cannot contain null values.

References

- Wilton, P., and Colby J. (2015) *Beginning SQL.*
- Database Answers Ltd. (2016) *Data Architecture*. Retrieved from: http://databaseanswers.org/data_models/
- LearnDataModel.com (7/16/2015) *How to create Data Modeling Objects in Toad.* Retrieved from: https://learndatamodeling.com/blog/create-data-modeling-objects-in-toad/
- Modern Database Management 10th Edition Jeffrey A. Hoffer, V. Ramesh, Heikki Topi
- Quest Software Inc. (2/19/2014) *Toad Data Modeler 5.2 – User Guide.* Retrieved from: http://documents.software.dell.com/toad-data-modeler/5.2/user-guide/projects-and-models/models/physical-data-model/basic-database-design/create-relationship
- Techopedia Inc. (2016) *Primary Key*. Retrieved from: https://www.techopedia.com/definition/5547/primary-key
- Ting Inc. (2016) *Ting Mobile That Makes Sense.* Retrieved from: https://ting.com/
- TutorialsPoint.com (2016) *Database Management System.* Retrieved from: https://www.tutorialspoint.com/dbms/dbms_tutorial.pdf
- Refsnes Data. (2016) *SQL General Data Types*. Retrieved from: http://www.w3schools.com/sql/sql_datatypes_general.asp
- Wilton, P., and Colby J. (2015) *Beginning SQL.* Retrieved from: http://index-of.es/eBooks/Wrox.Beginning.SQL.Feb.2005.pdf