Ez Rental Auto Management System

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Contents

PROJECT 1 – EZRental Auto POS Management System Database Design and Implementation

Executive Summary

EzRental INC has hired NYC-Tech Solutions to design and implement a POS System for an Auto Rental System that customers and employees can use. This document details the different steps that were undertaken to develop a solution for them.

This document focuses explicitly on the database component of the application to ensure functionality based on the various features that were required from the company, as well as the business requirements. The architects ensured that the solutions were designed to provide EzRental with efficiency, scalability, and a competitive advantage over their competitors, providing employees and customers with a performance-based system based on the requirements.

The target application was designed to support rental and corporate office employees and customers browsing the internet.
This project was an essential phase in the development of the full target application. With a tested and validated database, the front-end developers will not have to worry about its functionality.

Problem Statement & Objectives

This section explains the problem that NYC-Tech Solutions has solved for EZRental Inc. with the implementation of a full suite Management System Application.

EZRental Inc. hired **NYC-Tech Solutions Inc.**, to design & implement a suite of **Auto Rental Point-of-Sales Management System Application** that include the following business modules: **1) EZRental Point-of-Sales (POS) system** intended for ***Customer Service Representative*** and other ***employees*** in the ***rental agencies***, such as Maintenance Personnel, Vehicle Inventory Team, Transport Drivers etc. **2)** A **Corporate INTRANET Website** named **EZRentalCorp.com** intendedfor business employees in the corporate offices, and Rental Agencies, and finally, **3)** an **e-commerce INTERNET Website** name **EZRental.com** intended for customers to make and manage reservations via the public internet.

The **EZRental Auto Rental Management System** features have been designed to:

- Allow customers, both retail and corporate customers, to reserve vehicles for renting, like other in-person or online car rental systems such as **Avis, Hertz, Budget,** etc.
- The application provides the required functionalities for our Customer Service representatives and other front-line workers in our rental agencies to service in-person customers for renting and reservation processes.
- Provide the features for our business users in our corporate offices who need to create reports, perform analytics and other business functionalities related to the management of the reservations and rental of our vehicles, via our INTRENET PORTAL.
- Finally, features to allow customers to make & manage vehicle reservations, profile, account etc., via the public internet.
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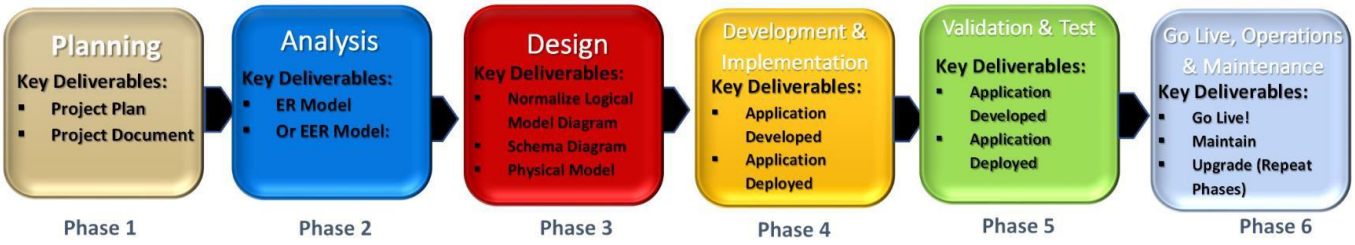
- The application has been designed to support dozens of major cities around the world. In addition, provides a great user experience both in the rental agencies as well as the online systems with the best competitive pricing available in the market.
- The company currently has rental agency branches in US, Canada, Mexico, United Kingdom, Japan & Australia and looking to expand further globally into other markets in Asia, Africa, and the Mediterranean.

Project Management Methodology

This section will describe the project management methodology that we decided was best to use to create this application. We used a mixture of the Agile and Waterfall techniques for various reasons such as organization and delivering working features to EzRental in a timely manner.

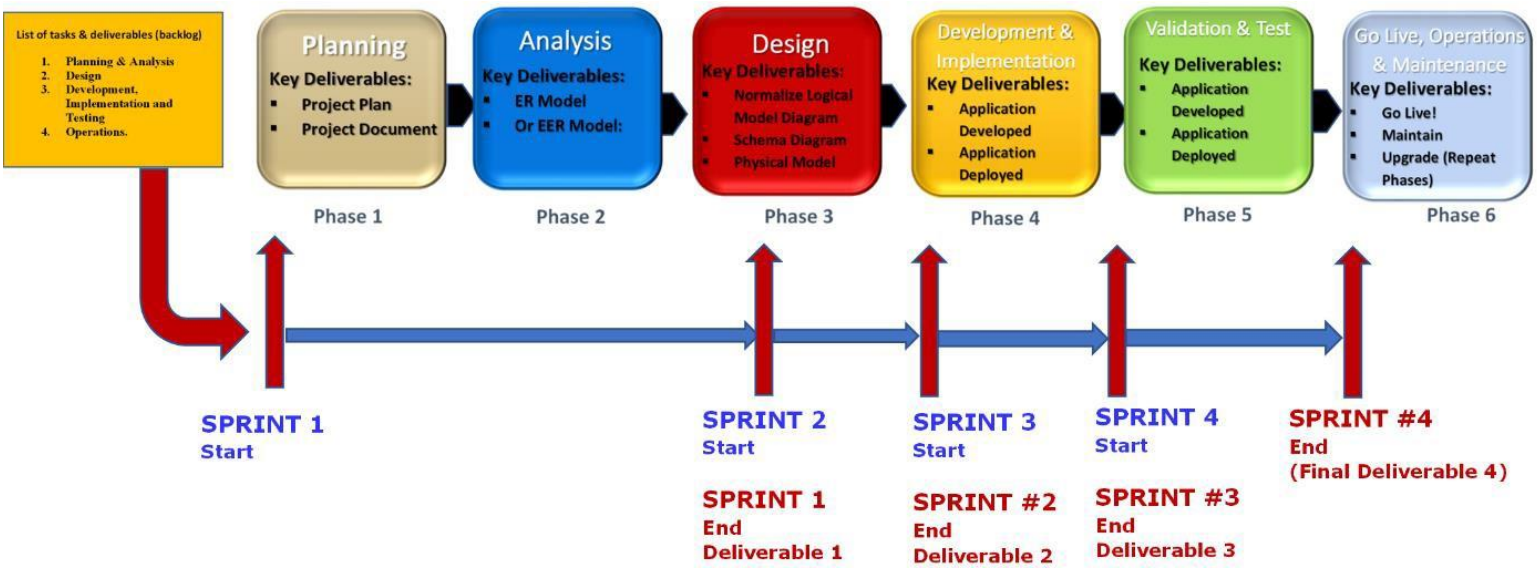
The 6 Phase Waterfall Methodology we used for this application

- The illustration below shows the **6 PHASES** and the main deliverables for each phase, followed by a table with a high-level overview of each phase:



WATEFALL PHASE	DESCRIPTION
Phase 1 – Planning & Discovery	▪ Planned the entire project & gathered requirements from business. **Performed the necessary discoveries via interviews, assessments, etc**., to properly plan, updated the methodology and executed the project, and most important, **Gathered Business Requirements**.
Phase 2 – Analysis	▪ Deep analysis of the identified **business requirements and other data discoveries from interviews and assessments**. This results in the foundation to **derive design strategy**.
Phase 3 – Design	▪ Designed the solution. Organized all the requirements and produce a detailed specification of all data elements, required web forms, reports, displays, and processing or business rules. Designed database models, webforms and application connectivity.
Phase 4 – Development & Implementation	▪ Implemented the solution. Developed the DBMS Server Application (ER model, logical model, physical model, tables, view, stored procedures etc.).
Phase 5 – Testing and Validation	▪ Tested and validated the app to confirm it meets the requirements & works.
Phase 6 – Go Live and Operations	▪ Opened the application to all users. Monitored, backed up & maintained the system. ▪ Database application component prepared to be ready for future upgrades therefore, developed a disaster/recovery plan in place so if the computers crash you can recover your application.

- We did it by first dividing the Waterfall Methodology Phases into **SPRINTS** for 4 SPRINTS for a period of 5-Weeks. Diagram and SPRINTS descriptions table shown below:



- The table below describes each phase within an Agile SPRINT in detail:
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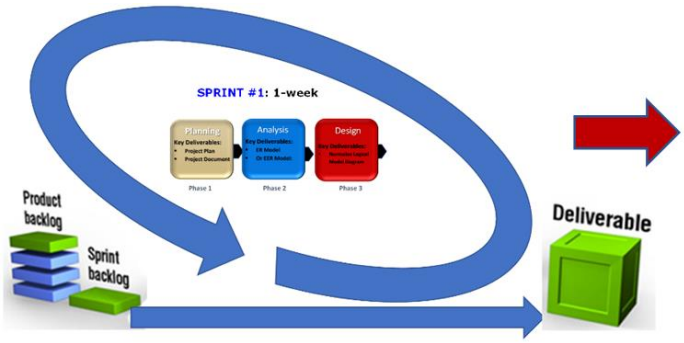
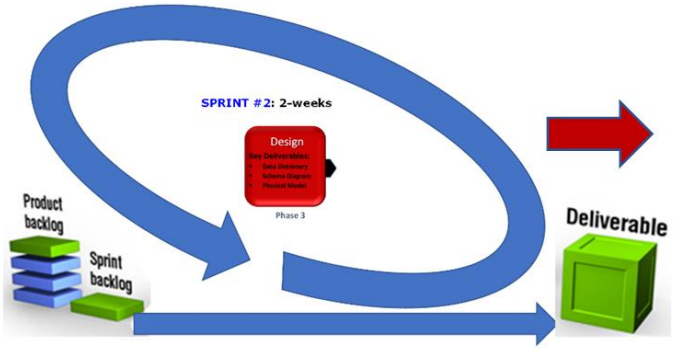
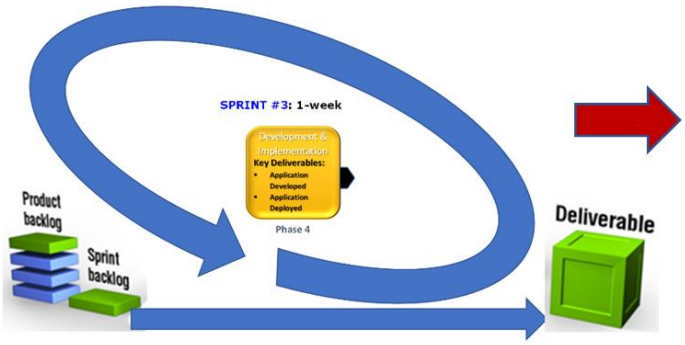
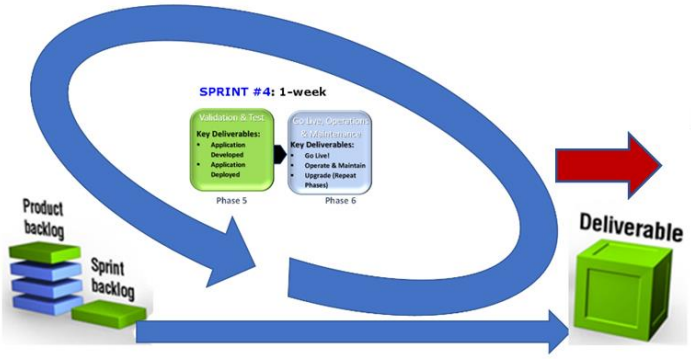
AGILE SPRINT #	WATERFALL PHASE	Output Deliverable
SPRINT #1	Planning	**1. Created Project Document – Formatted and populated as per requirements.** **2. Business Requirements (Included in Project Document – List of Business & Technical Requirements from customer.**
	Analysis	**3. ER/EER Conceptual Model Diagram**
	Design Phase (Part 1)	**4. Normalized Logical Model Diagram**
SPRINT #2	Design Phase (Part 2)	**5. Data Dictionary matrix** **6. Physical Schema Design Diagram – from Normalize Logical Model + DataDictionary combination.**
SPRINT #3	Development & Implementation	**7. Database application developed & implemented – This includes the Database application installed, setup and configured** **8. Generated the actual Physical Schema Diagram – from the Database & compared to the Physical Schema Design Diagram – to validate the design.**
SPRINT #4	Validation & Testing	**9. Unit & Integration testing.**
	Operations	**10. Operations – or keep database running. Keeping the lights on!**

- Second, we incorporated each **SPRINT** through the **Agile Methodology Process** for a total of **4 Sprints** with a total of **5-Weeks** shown in diagram below:









END of Project

Database Design Deliverable #1a – Application Business requirements

This section will describe the requirements that will be followed by NYC-Tech Solutions that have been given from EZRental based on interviews and assessments completed with the various stakeholders.

Business Requirements

About Us:

EZ-Car Rental is an auto rental company that rents vehicles such as cars, SUVs, minivans & cargo vans to customers. In addition, other specialized vehicles such as trucks, motorcycles, boats, mobile homes, etc. We operate in several countries with rental agency locations in the US, Canada, Mexico, UK, Japan & Australia. Within each country we own and operate rental agencies located in cities, regions and state. For example, New York City has 2 rental agencies in Manhattan, one in Brooklyn and two in Queens located at each airport. With multiple rental agencies in cities, states etc., a customer can pick up a vehicle in one location and drop it off at another.

Current Challenges:

Our current rental system is outdated, with a poor user-experience, inefficient (breaks often thus expensive to operate), does not meet our business requirements, and is not scalable (cannot be easily updated with new features). Another very important shortcoming of the current system, is the lack of elasticity since it does not give us the flexibility to scale-up or scale-down resources during business trends and seasonal changes in the market.

We want to invest in modernizing our business with a new vehicle management system that can meet these challenges and delivers a great user-experience, meet our new business requirements, scalable, and elastic to adopt to business trends and seasonal market changes. Elasticity is very important since recently we have been faced with a new type of competition; small rental companies that are nimble and can quickly adopt to market changes thus able to provide new offerings that are appealing to customers thus affecting our profits. These smaller competitors are using new technologies that enable them to be nimble and elastic. Figurative speaking "*they are eating our lunch*".

We look forward to your proposed architecture & implementation of this new system. Below are our business requirements.

Our Rental Agencies:

A **rental agency** is the location where customers visit to pick up and drop off rental vehicles. Each **rental agency** is identified by a unique ***rental agency ID*** number, ***agency name***, ***address*** that is composed of the following elements: ***address line1***, ***address line 2 (***which is optional and used for apartment number, suite or any additional address information required), **city**, ***state code*** (which is the two-character code for a state in the US), ***zip code*** & ***country***. In addition, we also need to capture the agency's ***phone number,*** and ***email*** which is unique for all agencies as all emails are.

Our Customers:

EZ-Car Rental offer their services to two types of **Customers**: **Corporate Customers** & **Retail Customers**. **Corporate Customers** are individuals whose corporation have a contract with us to use our services with special corporate rate for their employee's rental services. On the other hand, **Retail Customers** are consumers not associated with a company and engaging in personal rental.

Requirements for All Customers (Retail & Corporate Customers)

To run our business, the application must store the following customer information for <u>both</u> types of **customers** (***retail*** & ***corporate***) so this data is common to both types of customers:

- A ***Customer ID*** number which uniquely identifies the customer, ***customer name*** which is composed of: ***first name***, ***last name***.
- ***Birth date***, ***Age***, ***Address*** which includes the elements: ***address line1***, ***address line 2 (***which is optional and used for apartment number, suite or any additional address information required), ***city***, ***state code*** (which is the two-character code for a state in the US), ***zip code*** & ***country***.
- Customer ***phone number*** & ***email*** (unique like all emails and required to rent).
- In addition, a driver license is required to reserve and rent a vehicle. Therefore, we need to capture the unique ***driver license number (****an alpha numeric character string containing numbers & characters****.*** *Note that in the USA the format for the driver license number can be under 15 characters, but in other countries it could go up to 22 to 25 characters*) ***driver license expiration Date*** and ***driver license state***. In addition, note the following ***business rule*** policy regarding the business importance of the ***driver license number***:

1. ***The driver license number is used throughout the business to identify a customer for searching, reporting etc.***
2. ***Therefore, the driver license number is the main unique ID for a customer to be identified and managed from a business perspective.***

Business Requirements

Our Customers (Cont.):

- A very important attribute we need to capture for every customer is the **credit card**. For our credit card processing and transactions, we need to capture the following ***credit card*** components: ***credit card number*** that uniquely identifies the credit card and is a 16-character number digits. We also need to capture the ***credit card owner name***, in addition, credit card processing attributes such as ***credit card issuing bank code***, ***credit card issuing bank name***, ***credit card network company code***, ***credit card network company name***, ***credit card processing merchant service company code***, ***credit card merchant service company name***, ***credit card corporate merchant bank code***, and ***credit card corporate merchant bank name***. Important – further details on these credit card processing attributes will be provided in sections to follow. Is important that these attributes are clearly understood to correctly design the system.
- Other attributes of credit card are ***expiration date***, ***billing address*** composed of ***address line1***, ***address line 2 (***which is optional and used for apartment number, suite or any additional address information required), ***city***, ***state code*** (which is the two-character code for a state in the US), ***zip code*** & ***country***, ***credit card limit*** (which is the maximum amount of money a customer can charge on their credit card), ***credit card available credit*** (which is how much you have left to spend with your credit card or unused amount within your limit). Note that we will capture the credit card limit to a maximum of $999,999.99, since we don't expect our customers to have a credit limit of $1 Million dollars. Finally, ***activation status*** (which a is true if the credit card is active and can be used, or false when the credit card is not active or disabled).
- During the interview with business stakeholders provided the following ***Business Rules*** related to a credit card:

1. ***You cannot reserve or rent one of our vehicles without a credit card.***
2. ***A customer can have many credit cards they can use to pay for rental transactions***.
3. ***A credit card can be owned by the one customer or co-owned by other individuals such a family member or corporate entity the customer works for. Therefore, many customers can own the same credit card and a credit card can be owned by many customers***.

The Credit Card processing Workflow

Processing of the credit card transactions is a key part of this business and is important that we store data for each step of the credit card processing process. Therefore, the credit card processing attributes discussed in previous section need to be further analyzed and clearly understood. We will now provide the definition and detailed information on each of these credit card processing attributes: ***credit card issuing bank code***, ***credit card issuing bank name***, ***credit card network company code***, ***credit card network company name***, ***credit card processing merchant service company code***, ***credit card merchant service company name***, ***credit card corporate merchant bank code***, and ***credit card corporate merchant bank name***:

- ***Credit Card Processing Merchant Service Company*** – In credit card processing the merchant is the retailer where a customer purchased the goods and services and pay using a credit card. **EZRental Inc**., is the merchant in this scenario. The ***Credit Card Processing Merchant Service Company*** is the institution which works directly with the merchant (**EZRental Inc.**) to provide handle the credit card processing services and handles all the complexity of credit card processing and interactions with the other financial entities involved in the credit card processing process on behalf of the merchant (**EZRental Inc.**). The ***Credit Card Processing Merchant Service Company*** provides the Merchant or Business with the hardware which the customer swipes or inserts to pay for goods and services with their credit card. As part of the credit card processing cycle, the first financial institution which the ***Credit Card Processing Merchant Service Company*** interacts with is the ***Credit Card Network Company*** (which we will cover next)**.** The ***Credit Card Processing Merchant Service Company*** ensure the merchant (**EZRental Inc.**) is connected to the right ***Credit Card Network Company***. We will describe the ***Credit Card Network Company*** next, nevertheless, we need to capture the following information for the ***Credit Card Processing Merchant Service Company***:

- ***Credit Card Processing Merchant Service Company Code*** – In our business, we use and store a number code used to identify the *Credit Card Processing Merchant Service Company*. This code has business meaning and appears in reports and discussed by users. Therefore, a *Credit Card Processing Merchant Service Company* can be identified by this code.
- ***Credit Card Processing Merchant Service Company Name*** – In our business, we also use and store the name of the ***Credit Card Processing Merchant Service Company***. This name also has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Processing Merchant Service Company*** can be identified by its name.
- Below is a listing of the values/instances of the ***Credit Card Processing Merchant Service Company Code*** and ***Credit Card Processing Merchant Service Company Name*** we use at **EZRental Inc**:

Credit Card Processing Merchant Service Company Code	*Credit Card Processing Merchant Service Company Name*
1	**Stax by Fattmerchant**
2	**Helcim**
3	**Dharma Merchant Services**
4	**Payment Depot**
5	**National Processing**
6	**Block**
7	**Intuit Quickbooks**
8	**PayPal**
9	**Stripe**
10	**Flagship Merchant Services**
11	**Clover**

Business Requirements

Our Customers & Credit Card Processing (Cont.):

- ***Credit Card Network Company*** – In credit card processing the objectives of the ***Credit Card Network Company*** is to process transactions between the ***Credit Card Issuing Bank*** (which we will cover next) and the ***Credit Card Processing Merchant Service Company***. Covered previously. The ***Credit Card Network Company*** act like bridges between the ***Credit Card Issuing Bank*** that issue credit card and the ***Credit Card Processing Merchant Service Company*** that handles the transaction from the merchant (**EZRental Inc.**). The ***Credit Card Network Company*** that interacts with the ***Credit Card Issuing Bank*** to determine whether to approve or deny the transaction. And then the ***Credit Card Network Company*** notifies the merchant (**EZRental Inc.**) if the purchase was approved or denied. The ***Credit Card Network Company*** is a digital infrastructure that facilitates credit card transactions and prepares the transaction for the ***Credit Card Issuing Bank***. We will describe the ***Credit Card Issuing Bank*** next, nevertheless, we need to capture the following information for the ***Credit Card Issuing Bank***:

  - ***Credit Card Network Company Code*** – We use and store a number code to identify the ***Credit Card Network Company***. This code has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Network Company*** can be identified by this code.
  - ***Credit Card Network Company Name*** – In our business, we also use and store the name of the ***Credit Card Network Company***. This name also has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Network Company*** can be identified by its name.
  - Below is a listing of the values/instances of the ***Credit Card Network Company Code*** and ***Credit Card Network Company Name*** we use at **EZRental Inc.**:

Credit Card Network Company Code	*Credit Card Network Company Name*
1	**American Express**
2	**Visa**
3	**Mastercard**
4	**Discover**
5	**Diners Club**
6	**Interlink**
7	**Star**
8	**Accel**
9	**Interac**
10	**Visa ReadyLink**
11	**Pulse**
12	**JCB (Japan Credit Bureau)**
12	**Rupay**

Credit Card Issuing Bank – The ***Credit Card Issuing Bank*** is the financial or lending institution that offers the Credit Card and pays for the goods and services until the customer pays back the credit/loan. These are Banks, Lending Institutions, Credit Unions, Fintech companies, etc. These institutions issues/provides the credit for the customer. The cardholder borrows money from the credit card issuing bank each time they make a purchase, and when they pay their credit card bill, they're paying the ***Credit Card Issuing Bank***. We need to capture the following information for the ***Credit Card Issuing Bank***:

  - ***Credit Card Issuing Bank Code*** – In our business, we use and store a number code used to identify the ***Credit Card Issuing Bank***. This code has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Issuing Bank*** can be identified by this code.
  - ***Credit Card Issuing Bank Name*** – In our business, we also use and store the name of the ***Credit Card Issuing Bank***. This name also has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Issuing Bank*** can be identified by its name.
  - Below is a listing of the values/instances of the ***Credit Card Issuing Bank Code*** and ***Credit Card Issuing Bank Name*** we use at **EZRental Inc.**:

Credit Card Issuing Bank Code	*Credit Card Issuing Bank Name*
1	**American Express**
2	**Bank of America**
3	**Barclays**
4	**Capital One**
5	**Chase**
6	**Citi**
7	**Discover**
8	**Synchrony Bank**
9	**U.S. Bank**
10	**Wells Fargo**

Business Requirements

Our Customers & Credit Card Processing (Cont.):

- ***Credit Card Corporate Merchant Bank*** – In credit card processing, the ***Credit Card Corporate Merchant Bank*** is the bank used by the merchant **EZRental Inc.**, to handle credit card processing money transactions, payments, etc., between **EZRental Inc.,** and the ***Credit Card Processing Merchant Service Company*** that handles the Credit Card Processing on behalf of **EZRental Inc**. In short, it is the bank that has the bank account used by **EZRental Inc.,** to handler the accounting for Credit Card Processing Transactions. We need to capture the following information for the ***Credit Card Corporate Merchant Bank***:

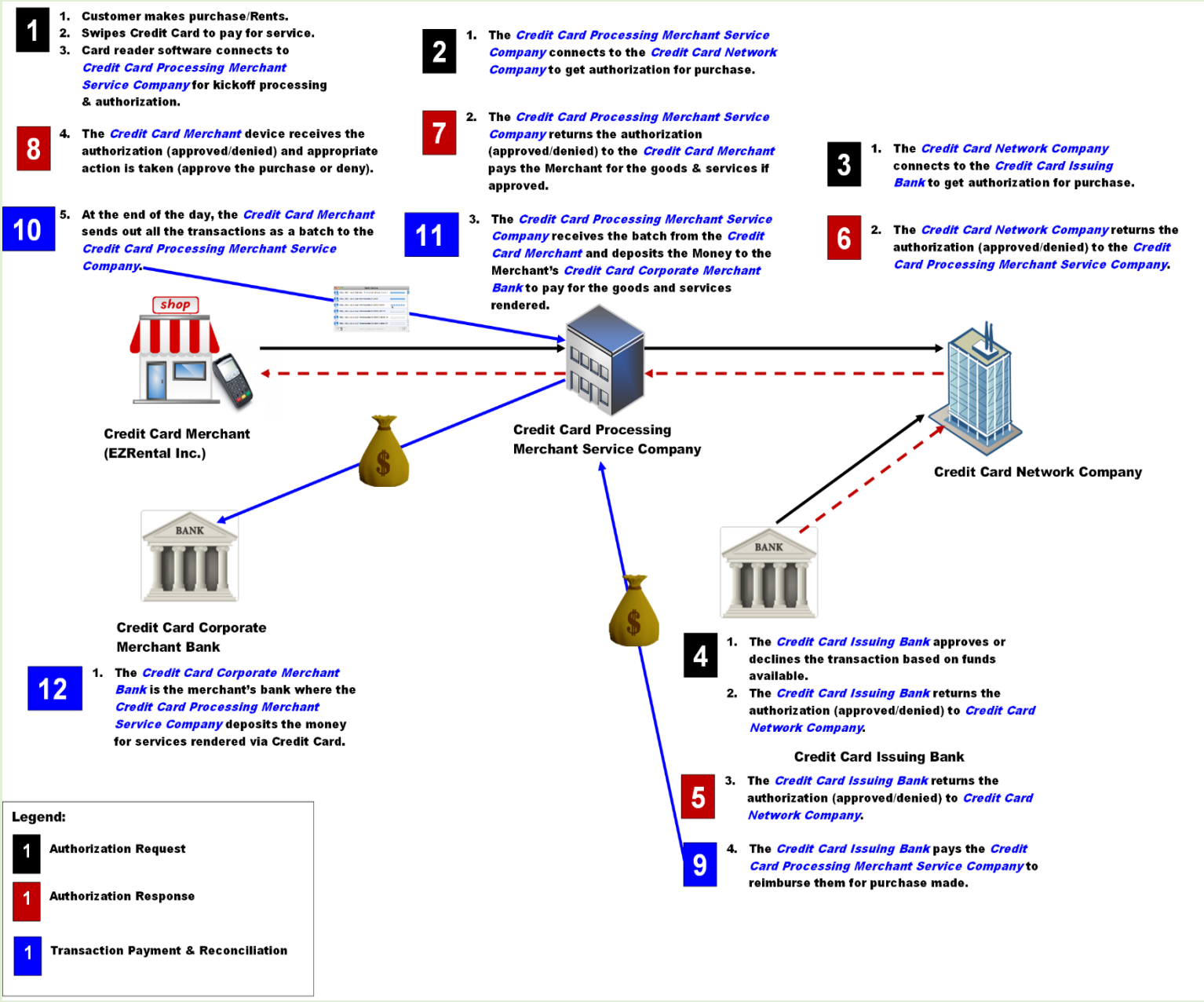
  - ***Credit Card Corporate Merchant Bank Code*** – In our business, we use and store a number code used to identify the ***Credit Card Corporate Merchant Bank***. This code has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Corporate Merchant Bank*** can be identified by this code.
  - ***Credit Card Corporate Merchant Bank Name*** – In our business, we also use and store the name of the ***Credit Card Corporate Merchant Bank***. This name also has business meaning and appears in reports and discussed by users. Therefore, a ***Credit Card Corporate Merchant Bank*** can be identified by its name.
  - Below is a listing of the values/instances of the ***Credit Card Corporate Merchant Bank Code*** and ***Credit Card Corporate Merchant Bank Name*** we use at **EZRental Inc.**:

Credit Card Corporate Merchant Bank Code	*Credit Card Corporate Merchant Bank Name*
1	**Chase**
2	**Citi**
3	**Capital One**

Business Requirements

Our Customers & Credit Card Processing (Cont.):

Below, is a pictorial representation of the interaction between the credit card processing entities ***Merchant (EZRental Inc.)***, ***credit card processing merchant service company***, ***credit card network company*** and ***credit card issuing bank***:



In summary, we need to capture the data for the credit card processing attributes: ***credit card issuing bank code***, ***credit card issuing bank name***, ***credit card network company code***, ***credit card network company name***, ***credit card processing merchant service company code***, ***credit card merchant service company name***, ***credit card corporate merchant bank code***, and ***credit card corporate merchant bank name***

Business Requirements

Our Customers (Cont.):

Corporate Customers

Corporate Customers are customers who are renting vehicle during business travel and their company have a contract with **EZRental Inc**. These companies get special corporate rate for their employee's rental services. Therefore, for our **corporate customers only**, we must store the following attributes/properties: unique ***company ID*** (we have a unique ID number for each company doing business with us), ***company name***, ***company address*** which contains the elements: ***address line1***, ***address line 2 (***which is optional and used for apartment number, suite or any additional address information required), ***city***, ***state code***, ***zip code*** (which is the two-character code for a state in the US) & ***country***, in addition, ***company contact*** which is composed of ***company representative name***, ***contact phone number*** & ***contact email*** (unique as all email addresses). And finally, we need to store the ***company discount percentage rate*** which is the discounted percentage applied to a corporate customers rental. The company Discount percentage rate is store in the database as a decimal percentage value, for example 20% is stored as 0.20, 30% as 0.30. 50% as 0.50 etc. This discount percentage (0.0x) is applied to the **Vehicle Rental Categories** which determines the price of each category to determine the total discount. Therefore, when a corporate customer rents a vehicle from a vehicle category (such as economic, compact, standard etc.), this discount percentage is applied to each of the categories during the rental/reservation process. Note that every company has a different percentage rating depending on their contract with **EZ-Rentals Inc**. For example, some companies have 20% discount towards their rentals, which would be stored as 0.20 in the database, some have 30% (0.30) etc. Vehicle Rental Categories are discussed in more details later in these requirements.

Retail Customers

Retail Customer Discounts

Retail Customers can (but don't have to) leverage promotional **discounts** or multiple coupons obtain from other businesses, internet, magazine, organizations, etc., to save money on their rentals. Therefore, we need to capture specific data for the promotional discounts used by a retail customer. A ***Promotional Discount*** is composed of the following attributes: ***discount ID***, a unique random number which uniquely identifies a discount, another unique ***discount code*** or the coupon code itself used to redeem the coupon, which is an alphanumeric code **10-characters** long. This code is generated by our marketing team and published to magazines, newspapers, internet e-commerce sites, etc. Finally, the last attribute is ***discount code description*** or description of the discount. Examples of currently used ***discount ID, discount code, discount code description*** are shown in table below:

Discount ID	*Discount Code*	*Discount Code Description*
1234..	AAA9970054	**AAA Membership Discount - 25% off base rate plus 10% donated for breast cancer research.**
5678..	GOV8756921	**Government Employee Discount - 30% off base rate**
9101..	*STA3415632*	**State Employee Discount for 25% off base rate**
1213..	VET2055179	**Veteran Discount 35% off base rate Plus 10% donation to veteran's family fund.**
Etc..	Etc..	**Etc..**

The following business rules were identified regarding the retail customer discount program:

1. ***Only a Retail Customer can use Discounts, no other type of customer, e.g., Corporate Customer, can apply a discount***.
2. ***Discounts are applied during reservation of a vehicle or during the actual rental process only***.
3. ***A Retail Customer can apply multiple Discounts throughout their lifetime as an EZRental Inc., customer, NEVERTHELESS, ONLY ONE Discount can be applied for a reservation or rental instance. You cannot apply multiple discounts to a reservation or rental***.
4. ***A Discount can be used by many Retail Customers and many Retail Customers can use a Discount***.
5. ***When a Discount is used by a Retail Customer, we need to capture the Discount Submitted Date which is the date the customer provided the discount and the Discount Redeemed Date which is the date the customer used the discount for a rental. In this business a customer can submit a discount during registration on one date but use it in a future date when they are renting***.

Business Requirements

Our Customers (Cont.):

Retail Customer EZPlus Rewards Program

Retail customers can opt-in to enrolled in the **EZPlus Rewards Program** where they earn points for every rental of a vehicle. These rewards points can be redeemed for future rentals. Note that the **EZPlus Rewards Program** is **optional** for retail customers & points are earned only when they rent vehicles. For the **EZPlus Rewards Program** we need to store unique random number ***EZPlus ID***, the unique ***Ezplus rewards code*** which is the code used in the business when managing the **EZPlus Rewards Program**. This random code is generated and assigned to a **Retail Customer** by the client application. The number starts with the 3-characters EZP and a 10-digit number e.g., **EZP9999999999**, and the final attribute is the ***EZPlus rewards earned points,*** which is an integer that indicates the number of rewards points earned that accumulated after all the rentals and can be used to save on future rentals.
Examples of currently used *EZPlus ID, EZPlus rewards Code* and *EZPlus earned points* that we currently use are:

EZPlus ID	*EZPlus Rewards Code*	*EZPlus Rewards Earned Points*
1234..	EZP9009854637	**10000**
5678..	EZP1000192461	**500**
9101..	EZP6493238865	**159000**
1213..	EZP2005135627	**23000**
	Etc..	**Etc..**

The following business rules apply to the EZPlus Rewards Program:

1. ***Only a Retail Customer can leverage the EZPlus Rewards Program, no other type of customer such as a Corporate Customer can join the EZPlus program.***

2. ***The EZPlus Rewards Program is OPTIONAL. A Retail Customer can join the EZPlus Rewards Program during registration or any other time after or not join at all.***

3. ***A Retail Customer can drop out of the EZPlus Rewards program at any time.***

4. ***Every time a Retail Customer that is member of the EZPlus Rewards Program rents a vehicle, they earn 1000 EZPlus Rewards Points. When a Retail Customer member of the EZPlus Rewards Program earns 10,000 EZPlus Rewards Points they earn a FREE RENTAL.***

As an incentive for our retail customers to join the **EZPlus Rewards Program** during registration to become a customer, we offer a ***EZPLus sign-up rewards points*** of **1000** ***EZPlus Rewards Earned Points***. Also note that the maximum number of ***EZPlus Rewards Earned Points*** is capped at **50,000** points. A Retail Customer cannot accumulate more than **50,000** points in the ***EZPlus Rewards*** program.

Business Requirements (Cont.)

Our Customers (Cont.):

In this business, we have the following business rules for our customers (***Retail*** or ***Corporate***):

1. ***We only have two types of customers retail customer or corporate customers. No other type of customer exists***.
2. ***The minimum age to be a customer and rental our vehicles is 21 years old***. ***This rule must be enforced***.
3. ***A customer cannot be a retail & corporate customer at the same time. A customer can only rent as a retail customer or as a corporate and these transactions must be separate. We don't want our customers to be able to combine both retail customer discounts, rewards program and corporate rates at the same time***.

Our Vehicles:

EZ-Car Rental needs a system to manage their vehicles for renting, maintenance, selling, etc. Vehicles are classified into 4 main types: **CAR**, **SUV**, **MINIVAN**, and **CARGO VAN**. These are the vehicles most rented and available at every rental agency. Nevertheless, there are other categories of vehicles available only certain rental agency locations such as **RECREATIONAL VEHICLES**, **MOTORCYCLES**, **MOBILE HOMES**, etc. No matter what type of vehicle being rented, all vehicle types share the following common characteristics:

- Each vehicle is identified by the random number ***vehicle ID***. In addition, each vehicle is also identified by the alpha-numeric ***vehicle VIN number***. Note the following business rule on a ***vehicle VIN number***:

    1. ***The vehicle VIN number is used throughout the business to identify a vehicle for searching, reporting etc.***
    2. ***Therefore, the vehicle VIN number is the unique ID for a vehicle to be identified and managed from a business perspective.***

- Other attributes include the ***vehicle name*** composed of ***make, model*** & **year**. Additional attributes are ***color***, also the ***license plate*** composed of the following components: ***license plate number***, ***license plate state***.
- More attributes are ***mileage***, ***transmission type*** of the vehicle. The Transmission Type attribute has business value thus used in reports and in the business processes. The values used for ***transmission type*** and a ***transmission type description*** as follows:

Transmission Type	*Transmission Type Description*
1	**Manual Transmission**
2	**Automatic Transmission**
3	**Continuously Variable Transmission (e.g., CVT).**
4	**Semi-automatic Transmission**
5	**Dual-clutch Transmission**
6	**Transaxle Transmission**

- ***seat capacity*** attribute, which is the number of seats in the vehicle. Vehicles such as *cars* have a seat capacity of 5 passengers (2 in front and 3 in the back), *SUVs* have 7 or 8 passengers. Cargo Vans have only 2 passenger seat capacity, Minivan have 8 to 9 passengers, special vehicles such as passenger van hold 12 passenger seat capacity, a shuttles bus can hold 16 to 20 passengers, mini-buses 30 to 40 passengers and large busses can hold 70 passengers.

- All vehicles also have a special code and description that we use to track the vehicle status named ***vehicle status ID***. This is a unique number that identifies the status of a vehicle, which works in conjunction with ***vehicle status description*** which describes the status represented by the ***Vehicle Status ID***, such as **reserved**, **rented**, **available**, **maintenance**, **not available**, **transferred**, etc. Below Is the list of vehicle status IDs we are currently using and their descriptions:

Vehicle Status ID	*Vehicle Status Description*
1	**Available**
2	**Reserved**
3	**Rented**
4	**Not available**
5	**Maintenance (Not available)**
6	**Dropped off and located at another agency**
7	**In Transport to Owning Agency**
8	**No Longer available for rental**

Business Requirements (Cont.)

Our Vehicles (Cont.):

In addition to these attributes shared by all vehicles, there are 4 main categories of vehicle which share unique characteristics than the other types of vehicles found in our agencies. These 4 types are as follows:

- A **Car** is a vehicle whose ***trunk capacity*** (measured in cubic feet volume) is advertised to our customers. Customers can decide which vehicles better fits their needs based on the trunk capacity and number of luggage they are carrying etc. For example, a *luxury Mercedes E class* car has a trunk capacity of 18.5 cubic ft., which has a large trunk capacity.
- An **SUV** is a vehicle with a ***towing capacity*** attribute in pounds. Towing capacity is a single number in pound or could also be a decimal number in pounds. For example, some of our SUV have a maximum towing capacity of 3,000 pounds etc. Another attribute of SUV is an attribute classification if the SUV is ***All-Wheel-Drive***, which stores a Boolean value of **YES/NO** or **TRUE/FALSE**.
- A **Minivan** has the option of ***having a disability package***, which is also a Boolean value of **YES/NO** or **TRUE/FALSE**.
- Finally, a **Cargo Van**, has a ***cargo capacity*** in cubic feet volume. For example, the typical volume of our Vans is 245 cubic feet (cu.ft.). Cargo Vans also have a ***maximum payload*** attribute that determines how much weight in pound it can hold. Our cargo vans have typically a maximum payload of 3,880 lbs.

- As stated previously, there are other types of vehicles of interest that in some location we may want to store data on other than car, SUV minivans and cargo van.
- Note that the following Business Rules were identified by the business stakeholders on the vehicles:

1. ***A reservation/rental can only be for one of these four categories of Vehicles or other vehicle types, not a combination***.

2. ***This means, you can only rent either a car, SUV minivans, cargo van or other for a reservation or rental, not a combination such as a car & SUV at the same time. Each reservation is unique to one vehicle***.

Below are additional business rules for our vehicles and agency ownership:

1. ***Every vehicle is owned by one agency. The vehicle can be pick-up and dropped-off at any agency, but only one agency is the vehicle's owning agency. An agency can own many vehicles, but a vehicle can only be owned by one agency***.

2. ***A vehicle can currently be located at any agency depending on where it was dropped-off after a rental. We need to track the current agency where the vehicle is located, to arrange a transfer or a rental that will ultimately direct the vehicle to the owning agency***.

Reservation Process:

A vehicle must be reserved if a customer wants to guarantee the vehicle will be available for rental. There is a distinction between a reservation and a rental. A reservation guarantees a vehicle will be ready for you to be pick-up and rented. A rental means a customer complied with the reservation and rented the vehicle. On the other hand, a customer can walk into an agency and rent without reservation but only vehicles that are available at the time and not reserved.

We have the following business rules for reserving a vehicle reservation:

1. ***A reservation is NOT made for a specific vehicle, but to a vehicle rental category. Rental category examples are economy, intermediate, full size, luxury***.

2. ***Thus, a customer makes a reservation of a vehicle rental category at a rental agency. Therefore, the reservation process involves a customer a vehicle rental category and the rental agency*** where the vehicle will be picked up.

Business Requirements (Cont.)

Reservation Process (Cont.):

A **Vehicle Rental Category** contains a list of vehicles depending on the vehicle type: Car (economy, intermediate, full size, luxury), SUV (standard, full size etc.), or Cargo Van etc. Each of these categories have a different price range. Therefore, for a vehicle rental category we need to capture the unique ***vehicle rental category ID*** that identifies the category of the vehicle being reserved or rented, ***category name*** and finally ***category daily rental rate*** for the category. We used a specific code for our vehicle rental category ID, category name & daily rental rate. The table below shows the ID, category names and rate we currently using in our business:

Vehicle Rental Category ID	*Vehicle Rental Category Name*	*Category Daily Rental Rate*
1	**Car-Economic**	**$113.99**
2	**Car-Compact**	**$115.99**
3	**Car-Intermediate**	**$116.67**
4	**Car-Standard**	**$119.99**
5	**Car-Full Size**	**$121.99**
6	**Car-Premium**	**$127.79**
7	**Car-Luxury**	**$139.99**
8	**SUV-Intermediate**	**$127.99**
9	**SUV-Standard**	**$128.99**
10	**SUV-Standard Elite**	**$135.99**
11	**SUV-Full Size**	**$148.99**
12	**SUV-Premium**	**$157.99**
13	**Minivan-Standard**	**$152.99**
14	**Van-Cargo Van**	**$19.95**
15	**Pick Up-Mid Size**	**$69.95**
16	**Pick Up-Full Size**	**$105.99**
17	**Motorcycle-Touring**	**$19.95**
18	**Motorcycle-Cruiser**	**$199.99**
19	**Motorcycle-Scooter**	**$79.95**
20	**Passenger Van (12 passengers)**	**$161.00**
21	**Passenger Shuttle (16 passengers)**	**$180.00**
22	**Passenger Shuttle (20 passengers)**	**$220.00**
23	**Passenger Mini-Bus (30 passengers)**	**$250.00**
24	**Passenger Mini-Bus (40 passengers)**	**$280.00**
25	**Passenger Large-Bus (80 passengers)**	**$300.00**

We have the following business rule relate to a vehicle and a vehicle rental category:

1. ***A vehicle is a member of a vehicle rental category***.
2. ***A vehicle rental category can have one, none or many vehicles belonging to that category at any given time, nevertheless, a vehicle can only belong to one vehicle rental category***.

As stated previously, **a customer makes a reservation of a vehicle rental category at a rental agency**. Therefore, the reservation process requires the **customer**, **vehicle rental category** & **rental agency** for a reservation to be made. The following business rules apply to a reservation:

1. ***A vehicle can be reserved to be picked up at the INDICATED rental agency and dropped off at the SAME rental agency***.
2. ***A vehicle can be reserved to be picked up at the INDICATED rental agency and dropped off at a DIFFERENT rental agency***.
3. ***A reservation is made only for one pick-up rental agency, but a rental agency can have many reservations for pick-ups taking place***.
4. ***A reservation can only be for one drop-off rental agency, but a rental agency can have many reservations drop-offs taking place***.
5. ***For reporting and analytics, we need to capture all changes to the reservation's pick-up and drop-off agency, such as all changes by the customer for pick-up agency & drop-off agency later after the original reservation. This means we need to store all history on all reservation pick-and drop-off agency changes***.

When a customer reserves a vehicle rental category for a specific rental agency, we wish to capture the following:

- A unique ***reservation ID*** which is used by the business to manage and track reservations, the ***rental agency ID*** where the vehicle will be picked up, and the target ***reservation drop-off rental agency***.
- In addition, we need to store the ***reservation schedule*** composed of ***reservation pick up date***, ***reservation pick up time***, ***reservation drop off date*** and ***reservation drop off time***, also the ***reservation estimated rental cost***. A reservation can have multiple schedule changes during the lifetime of the reservation since customers can make changes to the reservation and we need to track this history of changes for analytical purposes.

Business Requirements (Cont.)

Reservation Process (Cont.):

We have the following business rule relate to the ***reservation schedule***:

1. ***For reporting and analytics, we need to capture all changes to the reservation schedule, such as all changes by the customer for pick-up date & time and drop-off date & time. This means we need to store all history on all reservation schedule changes.***
2. ***A customer can have MANY reservation schedules based on changes to the reservation, but a schedule can only belong to ONE customer.***

- Finally, we need to store the unique ***reservation status ID*** which is a unique number we use to indicate the status of a reservation and ***reservation status description*** which describe each of the status such as: **confirmed**, **cancelled**, **completed** etc. Below is an example of the ***reservation status ID*** and ***status description*** we currently use in our business.

Reservation Status ID	*Reservation Status Description*
1	**Confirmed**
2	**Modified & reconfirmed**
3	**Cancelled**
4	**Fulfilled & closed**
Etc..	**Etc..**

For a reservation we must adhere to the following business rules:

1. ***A customer can make none, one or many reservations for a vehicle rental category at a rental agency.***
2. ***A rental category can be reserved by none, one or many customers at a rental agency.***
3. ***A rental agency can get many or no reservations for a vehicle rental category by a customer.***
4. ***A reservation can only have one pick-up rental agency location, but a rental agency can have many reservation pick-ups happening.***
5. ***Each reservation has a drop-off rental agency (may be different than pick-up rental agency). A reservation can only have one drop-off rental agency location, but a rental agency can have many reservation drop-offs taking place.***

The Rental Process:

Once a vehicle has been reserved, the vehicle can be rented (picked up/dropped off) as per the scheduled of the reservation agreement. **A rental means a customer complied and fulfilled the reservation and rented the vehicle**.

For the rental process, the following business rules apply:

1. ***A customer rents a vehicle Rental Category at a rental agency. This means the rental process requires the customer, vehicle rental category, and & rental agency for a rental to be complete.***
2. ***A Rental includes a specific Vehicle of the vehicle rental category. A vehicle can be rented many times, but a rental is only for one vehicle only. You cannot rent multiple vehicles in one rental contract.***
3. ***During the rental process we may have any of the following business rules/scenarios:***

    1) ***A vehicle can be picked up at the SAME rental agency as indicated by the reservation and dropped off at the SAME rental agency.***
    2) ***Or a vehicle can be picked up at the SAME rental agency as indicated by the reservation and dropped off at ANOTHER rental agency.***
    3) ***Or a vehicle can be picked up at ANOTHER rental agency other than what was indicated by the reservation and dropped off at SAME rental agency of the reservation.***
    4) ***A vehicle can be picked up at ANOTHER rental agency other than what was indicated by the reservation and dropped off at ANOTHER rental agency of the reservation.***
    5) ***For reporting and analytics, we need to capture all changes to the rental pick-up and drop-off agency, such as all changes by the customer for pick-up agency & drop-off agency later after the original reservation. This means we need to store all history on all rental pick-and drop-off agency changes.***

    - Note that for scenarios 3 & 4, we cannot guarantee that the vehicle rental category of the reservation will be available at the agency other than what was agreed in the reservation. We will do our best to accommodate the change during these scenarios or find another vehicle that will be closed to the original reservation.
    -

For the rental process, the following business rules also apply:

1. ***A rental can only be for one pick-up rental agency, but a rental agency can have many rental pick-ups taking place.***
2. ***A rental can only be to one drop-off rental agency, but a rental agency can have many rental drop-offs taking place.***

When a customer rents a vehicle at the rental agency, we need to capture the following information about the rental:

- The ***rental agreement ID*** that uniquely identifies the rental transaction, ***rental pick up date***, ***rental pick up time***, ***rental drop off date*** and ***rental drop off time***, ***rental pick up odometer value*** and ***rental drop off odometer value***.

Business Requirements (Cont.)

The Rental Process (Cont.):

- In addition, a customers receive a vehicle with a full tank of gas and customers are expected to return the car on a full tank of gas otherwise they must pay a penalty upon return. Since we understand our customers are busy and may forget to return the car with a full tank of gas, we offer our customers with the option to pay in advance for a full tank of gas at our rates and don't have to worry about returning the vehicle with a full tank of gas. Therefore, we need to capture the unique ***rental fuel option ID*** or option chosen by the customer, ***rental fuel option description*** and ***rental fuel option additional cost***. We currently use the following fuel option IDs, descriptions, and example of each of the additional cost for the fuel option:

Rental Fuel Option ID	*Rental Fuel Option Description*	*Rental Fuel Option Additional Cost*
1	**Return with a full tank or on return, pay for gas that is missing.**	**$13.97**
2	**Pay for full tank in advanced at time of rental, return car empty. No refund for unused gas.**	**$45.99**

- Also, we give customer options for car insurance & protection, therefore we need to capture the unique ***insurance option ID***, ***insurance option description*** and ***insurance option additional cost***. We currently use the following insurance option IDs, descriptions, and cost:

Rental Insurance Option ID	*Rental Insurance Option Description*	*Rental Insurance Option Additional Cost per Day*
1	**No insurance. Opt-out.**	**$0.00**
2	**Collision Damage Waiver Max - Agency will pay for damage, lost or stolen vehicle.**	**$49.99**
3	**Collision Damage Waiver 3000 - Agency will pay for first $3,000 of loss or damage, renter pays all loss & damage after $3,000.**	**$39.99**
4	**Lability Extended Protection – Agency provides renter with third party liability protection up to $1 Million per accident for bodily injury or death or property damage to others.**	**$89.99**
5	**Roadside Assistance Plus – 24/7 roadside assistance, replacement for lost keys, flat tire service, fuel delivery, etc.**	**$15.99**

- Other attributes required for the rental that we need to capture are the unique ***rental status ID*** & ***rental status description***. We currently use the following rental status IDs & descriptions:

Rental Status ID	*Rental Status Description*
1	**Picked up as scheduled.**
2	**Dropped off as scheduled.**
3	**Returned late**
4	**In progress.**
5	**Roadside assistance in progress.**
7	**Unknown**

The Rental Process (Cont.):

- Other attribute we need to capture the ***rental deposit*** for a rental. The rental deposit value is calculated based on the **rental period + 25% of the rental period** and for any damage or other charges that were incurred during the rental period. This deposit is refunded to the customer's credit card when the vehicle is returned in the condition in which it was rented.
- Finally another attribute we need to capture is the ***rental total cost*** or total cost that needs to be paid by the customer. This value is calculated based on selected *fuel option*, *insurance option*, *vehicle rental category* price and other factor such as such as duration of the rental etc.

We need to be able to associate a reservation to a rental and vice versa, therefore we maintain the following additional business rules for our rental & reservation:

1. ***A reservation is made for a rental and the opposite holds true; a rental is based on a reservation***.
2. ***But NOT all rentals are based on a reservation. We allow a customer to walk into a rental agency and rent a vehicle without a reservation***.
3. ***When a reservation is made for a rental, then it must be for only one rental, and a rental can be for a reservation but not mandatory since a customer can walk into an agency and rent a vehicle without a reservation***.

Our Employees:

EZ-Car Rental currently has 5,500 employees across the world. We do expect to grow as we move into new markets such as Asia, Africa, and the Mediterranean. But our business does not require a large workforce, therefore, we don't expect to grow more than 12,000 in the next 10+ years. Our employees consist of *customer service agents* in the Rental Agencies & online support who interact with our customer to reserve and rent vehicles. In addition, *back-office inventory personnel*, *auto specialists* who work in our services centers servicing our vehicles, *drivers* to transport our vehicles from one agency to another and *maintenance personnel* who maintain our agencies and finally our *business team* that handles the day-to-day business activities in our agencies and other roles. For now, we are only interested in storing the following data for all these types of employees:

- An ***Employee ID*** which uniquely identifies the employee, ***employee name*** which is composed of: ***first name***, ***last name***, also ***employee address*** which includes the components: ***address line1***, ***address line 2***, ***city***, ***state code***, ***zip code*** & ***country***. Also, ***employee phone***, ***employee job title*** and ***employee email***. In addition, we need to capture the employee ***social security number***. Below are some business rules and usage for the ***EmployeeID*** and the ***social security number***.

The following business rules related to employees must be followed:

1. ***The employee social security number needs to be protected and secured as per federal regulations. All security measures such as encryption, etc., need to be taken to protect the social security number; therefore, the full social security number cannot be seen by employees, reports, and other business processes***.
2. ***In special cases where the social security number needs to be displayed, only the last 4 digits will be shown using the following format ****_**_1234. Nevertheless, the goal is NOT to display the social security number as much as possible, and it should only be used internally within the application for processing but not displaying***.
3. ***The EmployeeID number is what is used throughout the business to identify an employee for searching, reporting. business processing, etc., therefore, the EmployeeID is the unique ID for an employee to be identified and managed from a business perspective***.
4. ***The minimum age to be an employee of our company 18 years old. This rule must be enforced***.

Security & Application Access:

To access our systems proper security and authentication is required. Only authorized users can have access our agencies Point-0f-Sales & Back-End Management systems. In addition to our **EZRental.com** portal by our customers. Therefore, due to security and regulatory compliance purpose, we want to separate the employee access data from the customer access data by using two separate user accounts:

- Employee user accounts
- Customer user accounts

Security Access for Employees to Computer Systems in our Agencies (Employee User Accounts):

For our authorized employees & customer service employees to access the agencies Point-0f-Sales & Back-End Management systems they need to log in by entering a username & password for access to the application. This means every employee owns an employee user account.

An employee user account should store the user ***employee user account ID*** a unique identifier alpha-numeric string that identifies the employee user account, ***employee username*** another unique alpha-numeric that identifies each individual user, the ***employee password*** alpha-numeric that is known only to the user, and finally the employee ***email*** to map the user-account to an Employee. Note the following business rule:

1. An employee can own one employee user account only, and an employee user account can only be owned by one employee only since the user account represents the identify of that one employee.

Business Requirements (Cont.)

Security Access for our Customers who register for our EZ-CarRental.com web site (Customer User Accounts):

Customer who accesses our online portal to reserve and rent our vehicles also need a username and password to access our system, therefore each customer owns a customer user account.

A customer user account should store the user ***customer user account ID*** a unique alpha-numeric string identifier that identifies the customer user account, ***customer username*** another unique alpha-numeric value that identifies each customer, the ***customer password*** that is an alpha-numeric known only to the customer, and finally, the customer ***email*** to map the customer user-account to a customer. Note the following business rule:

1. A customer can own one customer user account only, and a customer user account can only be owned by one customer.
2. For a period of time, we will need to register customers into our **EZRental.com** business, nevertheless the web portal may NOT be implemented or completed when new customers are registering at this time, therefore, for period of time, creating a customer user account when registering a new customer is optional until the Web Portal Application is created. But is important in the future, that we force the creation of customer user accounts when a new customer is registered once the Web Portal Application is ready. It is the responsibility of the database architect(s) and full-stack developers to update this feature when the appropriate time comes.

Vehicle Transportation:

We need to know where our vehicles are located at all times, such as at the Rental Agency that owns the vehicle, another Rental Agency that does not own the vehicle, being transported from one Rental Agency to another as a result of a vehicle transfer after a rental to the owning rental agency, being transported as a new delivery to a Rental Agency from our distribution center, being transported for maintenance, or currently being rented by a customer. Vehicles need to be tracked or location status known. At this time, we are only interested in tracking when a vehicle is transported from one Rental Agency to another Rental Agency under the following scenarios:

- Vehicle can be located at a Rental Agency that does not own the vehicle after a rental dropping off at a different location than the picked up owning Rental Agency, thus vehicle eventually needs to be transported and delivered to the owning agency.
- Another non-owning Rental Agency requests support from other Rental Agency(s) for loans of vehicle(s) to borrow due to an unexpected busy period and requesting agency is short on inventory. After the first agency is done with the loaner vehicles, these vehicles need to be returned to the borrowed owning Rental Agency(s).
- In our current process & systems we currently use the following reason IDs and reason descriptions:

Transport Reason ID	*Transport Reason Description*
1	**Rental Drop off at different location**
2	**Vehicle Loaned to another Agency**
3	**Pick up from Distribution Center**
4	**Drop off to Distribution Center**
5	**Vehicle sent for maintenance**
7	**Unknown**

Note that transportation to and from Rental Agency is executed by an employee who is part of a transportation team or drivers. Therefore, when an employee executes a transport request of a vehicle to and from Rental Agencies, we need to capture the following information:

- ***Transport pickup agency ID***, ***Transport drop-off agency ID***, ***Driver departure date***, ***driver departure time***, ***vehicle pick up date***, ***vehicle pick up time***, ***transport completed arrival date***, ***transport completed arrival time***, ***estimated arrival date***, ***estimated arrival time***, & actual ***transport time to completion***.

- In addition, we need to know at any time the transport status and transport status description of the transfer, such as: transfer completed, on route to pick up location, on route from pick up location, etc. Therefore, we need to capture the ***Transport Status ID*** or unique number that identifies a status and the ***Transport Status Description***, or description of each status ID. Currently we track a transportation event using the following ID and description:

Transport Status ID	*Transport Status Description*
1	**Transport completed**
2	**On route to pick up location.**
3	**On route from pick up location**
4	**At pickup location. In progress (Loading etc.)**
5	**Pickup location delay**
7	**Unknown**

The goal again is to be able to know where our vehicles are located at any time and their status.

Business Requirements (Cont.)

Conclusion:

The business data listed in this business requirements document is what we need to capture for our business to operate. As our business evolve, additional data will be required in the future. We will address these new requirements in future versions of the application. For example, invoice processing & employee management at our rental agencies are features on our roadmap. Therefore, our expectations are that the design is modular and scalable for future growth.

Database Design Deliverable #1b – Application Development Technical Requirements

Application Development & Technical Requirements

Introduction & Current Challenges

As described in the Business Requirements, the current rental system is outdated, with a poor user-experience, breaks often thus expensive to operate, does not meet our business requirements, and is not scalable so it cannot be easily updated with new features etc. Also, not elastic since it does not give us the flexibility to scale-up or scale-down based on business trends and seasonal changes in the market. We want to invest in modernizing our business with a new vehicle management system that can meet these challenges and give us a great user-experience, meet new business requirements, scalable, and elastic to adopt to business trends and seasonal market changes.

We have an outdated IT infrastructure in our datacenter and there is a current initiative to modernize our datacenter and also leverage cloud technology in a hybrid environment to save on cost, streamline our operations and drive innovation.

We look forward to your proposed architecture & implementation of this new system that will meet these requirements. Next sections contain the results of our application development & technical requirements.

Rental Agencies Application & Technical Requirements:

The rental agencies are location where customers both Retail & Corporate will engage our *Customer Service Representatives* to engage in rental/return activities in addition to other transactions such as registering, searching & updating customer information etc. Therefore, the application in the rental agencies is vital to the user-experience for both our *Customer Service Representatives* as well as our *customers*.

We are forecasting that is some locations such as major city centers and airports, there will be many customers engaging throughout the day thus increasing the risk of a poor customer experience in addition to the work overload and poor experience for our *Customer Service Representatives*. We want our *Customers* to be serviced quickly and efficiently with a great experience, and our *Customer Service Representatives* to be able to process each *Customer* easily and effectively. With these criteria in mind, the application at our rental agencies must adhere to the following requirements:

Rental Agency Application Architecture Requirements:

Below are the requirements for the application used in our rental agencies by our customer service representatives, inventory team, service personnel and other employees working in our agencies:

1. Client application processing, transaction and response must be fast to minimize service time for a customer.
2. All transaction processing should be done in the user's computer or desktop for fast processing and response.
3. Application Architecture must be reusable and scalable to support future updates and new feature enhancements, without a long development lifecycle.
4. Depending on the architecture NYC-Tech Solutions Inc., decides for the application in the rental agencies (Desktop client or Web client), the primary Application Development Platform we use is ***C# & .NET technologies***. For any Web related development, we support JavaScript, React, NodeJs and other standard Web Technologies. We have aligned ***C#.NET*** & **ASP.NET Web developers** that have been assigned to assist, support and update the application once NYCTech consultants complete the project and development of this system.
5. Rental Agency Desktop Application Security Authentication System – Proper security and authentication must be implemented to make sure only authorized customer service representative and other rental office employees can access the Point-0f-Sales with appropriate conditional access.

Rental Agency Application Features and Functionalities Requirements:

The list of features and functionalities that we have compiled for the rental agencies' application are listed in the table below:

No.	Feature	Functionalities
1	**EZRental** Rental Agency Point-of-Sales (POS) System	▪ Car Rental, Car Return, New Customer Registration & Search/Print Customer Information, Customer Update, Customer Deletion, Customer Listing operations etc.
2	**EZRental** Rental Agency Back-Office Vehicle Inventory Management System	▪ Back-office system meant for employees to perform bulk IN-MEMORY inventory processing or management tasks on vehicles such as adding vehicles to the system, searching for vehicles, updating vehicles etc. ▪ This system is NOT meant for Point-of-Sales, but for the inventory management employees who need to search, add, remove etc., a large/bulk number of vehicles or employees during a session. ▪ Back-office vehicle Management features – Allows inventory personnel and employees to bulk-manage Cars, SUVs, Mini-Vans, Cargo Vans to be searched, added, removed, printed, listed etc.
3	**EZRental** Rental Agency Back-Office Credit Card Management System	▪ The EZRental Credit Card Management System is a Back-office system meant for the Credit Card Department Employees to manage Credit Card Information. These uses can Search/Print, Add, Edit & Delete credit card information in the database
4	**EZRental** Rental Agency Back-Office Employee & Customer User Account Management System	▪ The EZRental Customer & Employee User Account Management System is a Back-end system meant for IT ADMINISTRATOR Employees to manage both Employee & Customer USER ACCOUNTS.
5	**EZRental** Rental Agency Desktop Application Security Authentication System	▪ Proper security and authentication must be implemented to make sure only authorized employees can access the Point-0f-Sales, Back-End Management system or any other access to the applications.

Rental Agency Application Graphical User Interface Requirements:

- Graphical User-Interface should be fast rendering and user-friendly workflow.
- Visual screens or forms should be rich in color and appearance and navigation flow should be flexible and easy.
- The following UI controls or data field need to be pre-populated in GUI Screens:

  - **Addresses**
    - Any forms/UI which contains addresses, the STATE & COUNTRY fields should be automatically populated with a list of STATES or COUNTRIES, so the user does not have to manually enter a state or a country and simply select from drop-down list etc.

  - **Discount Codes:**
    - UI screens with customer's DISCOUNT CODE fields should be prepopulated with discount codes. The idea is the user should be able to select the discount to apply to a customer entry from a drop-down list/Combo Box etc. Note that this may or may not include the Discount Code Description on the UI screen as well.
    - Also note that the DISCOUNT CODE VALUES are generated by our Marketing Team and need to be pre-populated in the database before a code can be used. Therefore, the discount codes are prepopulated in the database.
    - Currently, when the Marketing Team generates a new code, they make the request to the database administrator to manually enter an update any new Discount Codes.
    - In the future, we want the application to have the necessary features for the Marketing Team to be able to manage the discount codes. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

Rental Agency Application Graphical User Interface Requirements (Cont.):

- **EZPlus Rewards Codes:**
  - The EZPlus Reward UI screens with customer's EZPLUS REWARDS CODE fields should be prepopulated with the EZPlus Rewards code for the customer is being applied to. The idea is the user should be able to select the EZPLUS REWARD CODE to apply to a customer entry from a drop-down list/Combo Box etc. or be handled by the back-end database.
  - **Important:** The EZPLUS REWARDS CODE VALUES are NOT generated by a business entity in our organization, but AUTOMATICALLY GENERATED by the application on the fly when registering a new customer. This is a different approach compared to the DISCOUNT CODE which are generated by Marketing Team. In this case, the EZPlus Rewards Code values are generated by the application and available via the UI screen to be used or some other method of generation.
  - To finalize this requirement, the idea is the EZPlus Rewards Code should be automatically generated and either appear in the UI Screen or automatically generated in the database.

- **Company Name:**
  - UI screens with corporate customer's COMPANY NAME fields should be prepopulated with the list of corporations that are members of our corporate program, which enables our users to avoid having to manually enter the company name. Note that this may or may not include the Company ID in the UI Screen which is a unique number with business value that we assign to each company.
  - Note that the company names. Company ids and other company data are managed by our Corporate Sales Team and need to be pre-populated in the database before any corporate customer processing can be made. Therefore, the company information is prepopulated in the database.
  - Currently, when the Corporate Sales Team adds a new corporation or company into the program, they make the request to the database administrator to manually enter and add the new company to the database.
  - In the future we want the application to have the necessary features for the Corporate Sales Team to have the functionality to manage the data of our corporate companies via the application. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

- **Vehicle Status:**
  - UI screens for vehicle inventory management, VEHICLE STATUS field should be prepopulated with the list of vehicle status. Based on the business requirements, the current list of vehicle status is listed in table below:

Vehicle Status ID	*Vehicle Status Description*
1	**Reserved.**
2	**Rented.**
3	**Available.**
4	**Not available**
5	**Maintenance**
6	**Transferred to another agency**

  - Currently populating the database with a vehicle status record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the vehicle status data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

- **Rental Agency:**
  - UI screens that required adding or managing a RENTAL AGENCY field should be prepopulated with the list of rental agencies in our company.
  - Currently populating the database with a rental agency record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the rental agency data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

Rental Agency Application Graphical User Interface Requirements (Cont.):

- **Vehicle Rental Category:**
  - UI screens that require the use of the VEHICLE RENTAL CATEGORY fields, must be prepopulated with the list of vehicle rental categories. Based on the business requirements, the current list of vehicle rental categories is as follows:

Vehicle Rental Category ID	*Vehicle Rental Category Name*	*Category Daily Rental Rate*
1	Car-Economic	$113.99
2	Car-Compact	$115.99
3	Car-Intermediate	$116.67
4	Car-Standard	$119.99
5	Car-Full Size	$121.99
6	Car-Premium	$127.79
7	Car-Luxury	$139.99
8	SUV-Intermediate	$127.99
9	SUV-Standard	$128.99
10	SUV-Standard Elite	$135.99
11	SUV-Full Size	$148.99
12	SUV-Premium	$157.99
13	Minivan-Standard	$152.99
14	Van-Passenger Van (12 passengers)	$161.00
15	Van-Cargo Van	$19.95
16	Pick Up-Mid Size	$69.95
17	Pick Up-Full Size	$105.99
18	Motorcycle-Touring	$19.95
19	Motorcycle-Cruiser	$199.99
20	Motorcycle-Scooter	$79.95

  - Currently populating the database with vehicle rental category records is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the vehicle rental categories data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

Reservation Status ID	*Reservation Status Description*
1	Confirmed.
2	Modified & reconfirmed.
3	Cancelled & Closed.
4	Fulfilled & Closed.
Etc..	Etc..

- **Reservation Status:**
  - UI screens that require the use of the RESERVATION STATUS field, must be prepopulated with the list of reservation status data. Based on the business requirements, the current list of reservation status is as follows:

Reservation Status ID	*Reservation Status Description*
1	Confirmed.
2	Modified & reconfirmed.
3	Cancelled & Closed.
4	Fulfilled & Closed.
Etc..	Etc..

  - Currently populating the database with a reservation status record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the reservation status data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

Rental Agency Application Graphical User Interface Requirements (Cont.):

- **Rental Status:**
  - UI screens that require the use of the RENTAL STATUS field, must be prepopulated with the list of rental status data. Based on the business requirements, the current list of rental status is as follows:

Rental Status ID	*Rental Status Description*
1	**Picked up as scheduled.**
2	**Dropped off as scheduled.**
3	**Returned late**
4	**In progress.**
5	**Roadside assistance in progress.**
7	**Unknown**

  - Currently populating the database with a rental status record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the rental status data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

- **Rental Fuel Option:**
  - UI screens that require the use of the RENTAL FUEL OPTION field, must be prepopulated with the list of rental fuel options data. Based on the business requirements, the current list of rental fuel option is as follows:

Rental Fuel Option ID	*Rental Fuel Option Description*	*Rental Fuel Option Additional Cost*
1	**Return with a full tank or on return, pay for gas that is missing.**	**$13.97**
2	**Pay for full tank in advanced at time of rental, return car empty. No refund for unused gas.**	**$45.99**

  - Currently populating the database with a rental fuel option record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the rental fuel option data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

- **Rental Insurance Option:**

  - UI screens that require the use of the RENTAL INSURANCE OPTION field, must be prepopulated with the list of rental insurance options data. Based on the business requirements, the current list of rental insurance option is as follows:

Rental Insurance Option ID	*Rental Insurance Option Description*	*Rental Insurance Option Additional Cost per Day*
1	**No insurance. Opt-out.**	**$0.00**
2	**Collision Damage Waiver Max - Agency will pay for damage, lost or stolen vehicle.**	**$49.99**
3	**Collision Damage Waiver 3000 - Agency will pay for first $3,000 of loss or damage, renter pays all loss & damage after $3,000.**	**$39.99**
4	**Lability Extended Protection – Agency provides renter with third party liability protection up to $1 Million per accident for bodily injury or death or property damage to others.**	**$89.99**
5	**Roadside Assistance Plus – 24/7 roadside assistance, replacement for lost keys, flat tire service, fuel delivery, etc.**	**$15.99**

  - Currently populating the database with a rental insurance option record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the rental insurance option data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

Application Development & Technical Requirements

- **Transportation Reason Option:**

  - UI screens that require the user to populate the TRANSPORTATION OPTIONS field, must be prepopulated with the list of transportation reason options as shown in the table below:

Transport Reason ID	*Transport Reason Description*
1	**Rental Drop off at different location**
2	**Vehicle Loaned to another Agency**
3	**Pick up from Distribution Center**
4	**Drop off to Distribution Center**
5	**Vehicle sent for maintenance**
7	**Unknown**

  - Currently populating the database with a transportation reason option record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the transportation reason option data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade.

- **Transportation Reason Option:**
  - UI screens that require the user to populate the TRANSPORTATION STATUS field, must be prepopulated with the list of transportation status options as shown in the table below:

Transport Status ID	*Transport Status Description*
1	**Transport completed**
2	**On route to pick up location.**
3	**On route from pick up location**
4	**At pickup location. In progress (Loading etc.)**
5	**Pickup location delay**
7	**Unknown**

  - Currently populating the database with a transportation status option record is handled manually by the database administrator. In the future we would like the application to have the necessary features for our business to be able to manage the transportation status option data. This is not an immediate requirement out of the gate but should be targeted as part of a future upgrade

Customer Facing Self-Service Web-Portal Application Architecture Requirements:

We now address architecture requirements for the application used in customers via the public internet to make reservations to rent a vehicle, modify their personal account, profile etc.:

1. Customer will use a secure and standard Web Application via a Browser to access our self-service portal in the internet. We need a website to support all customer self-service related transactions.
2. Web Application Architecture must be reusable and scalable to support future updates and new feature enhancements, without a long development lifecycle.
3. For this web development, we support ***JavaScript***, ***React***, ***NodeJS*** and other standard Web Technologies. In addition, the primary Application Development Platform we use is ***C# & .NET technologies***. We have aligned ***C# & .NET*** & **Web** developers that have been assigned to assist, support, operated and update the application once NYCTech consultants complete the project and development of this system.
4. Web Portal Security Authentication System – Proper security and authentication must be implemented to make sure only the customer can access the **EZRental.com** website for his or her profile home page.

Customer Facing Self-Service Web-Portal Features and Functionalities Requirements:

The list of features and functionalities that we have compiled for the customer serf-service Web Portal are listed in the table below:

No.	Feature	Functionalities
1	**EZRental.com** Customer Web Portal	▪ Front-end WEB INTERFACE SCREENS & features used by customers via our web portal EZRentalCar.com to reserve a vehicle for rental and manage their account online. ▪ Features include search & reserve a car for rental, register as a new customer, search/view their account information, update their account etc.
2	**EZRental.com** Customer Web Portal Application Security Authentication System	▪ Proper security and authentication must be implemented to make sure only our customer can access the web portal to use the application.

Web Portal Application Web Pages User Interface Requirements:

The web pages graphical UI requirements are listed below:

- The GUI requirements for the web pages are like those functionalities of the Rental Agency Application that are found on the web site for example Search & reserve a car for rental, register as a new customer, search/view their account information, update their account etc.
- The design and graphics of the application should be appealing to customers and a smooth and fluent workflow.
- The following UI controls or data field need to be pre-populated in GUI Screens:

  - **Addresses**
    - Any web-page UI which contains addresses, the STATE & COUNTRY fields should be automatically populated with a list of STATES or COUNTRIES, so the user does not have to manually enter a state or a country and simply select from drop-down list etc.

  - **Discount Codes:**

    - Web pages with customer's DISCOUNT CODE fields should be a text box that allows the customer to ADD/APPLY the discount codes to redeem the coupon.

Rental Agency Application Graphical User Interface Requirements (Cont.):

- **EZPlus Rewards Codes:**

  - The EZPlus Reward web page screens with customer's EZPLUS REWARDS CODE fields should be prepopulated with the EZPlus Rewards code for the customer is being applied to. The idea is the user should be able to select the EZPLUS REWARD CODE to apply to a customer entry from a drop-down list/Combo Box etc. or be handled by the back-end database.
  - **Important:** The EZPLUS REWARDS CODE VALUES are NOT generated by a business entity in our organization, but AUTOMATICALLY GENERATED by the application on the fly when registering a new customer. The EZPlus Rewards Code values are generated by the application and available via the UI screen to be used or some other method of generation.
  - To finalize this requirement, the idea is the EZPlus Rewards Code should be automatically generated and either appear in the UI Screen or automatically generated in the database.

- **Rental Agency:**

  - Web pages that required adding a RENTAL AGENCY field should be prepopulated with the list of rental agencies in our company.

- **Vehicle Rental Category:**

  - Web pages that require the use of the VEHICLE RENTAL CATEGORY fields, must be prepopulated with the list of vehicle rental categories. Based on the business requirements, the current list of vehicle rental categories is as follows:

Vehicle Rental Category ID	*Vehicle Rental Category Name*	*Category Daily Rental Rate*
1	**Car-Economic**	**$113.99**
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18	**Motorcycle-Touring**	**$19.95**
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20	**Motorcycle-Scooter**	**$79.95**

Application Physical & Software Technical Architectures

This section provides an overview of the **design decisions that were** made by the **Business/Database Analyst**, **Application Full-Stack Architects** & **UX/User-Interface Architect**, for the application. It was selected with these individuals engaged in interviews, discovery and assessment conversations based on deep analysis of the **business requirements** and **technical requirements** to derived a strategy for both the ***design*** and ***implementation*** of the **EZRental POS Auto Rental Point-of-Sales Management System**.

- After a thorough review of both the ***business requirements*** and ***technical requirements*** by the project team, theresultant decisions on architecture (s) were based on the following:

- **Rental Agency Employees:**
  - The system in our agencies used by the customer service representatives or front-line workers, must be able to quickly respond and execute the necessary requests such as

    - **POS Customer Management (Retail Customer & Corporate Customer) features** such as ***Customer Search & Print, New Customer Registration***, ***Customer Update***, ***Customer Deletion***, & ***Customer Listing functionalities***
    - **POS Vehicle Reservation, Rental & Return Management Feature** such as ***Vehicle Reservations, Vehicle Rental & Vehicle Return functionalities.***
    - **POS Vehicle Inventory Management Feature** allows inventory personnel and employees to bulk-manage vehicles such as **Cars**, **SUVs, Mini-Vans**, ***Cargo Vans,*** and other vehicles to be ***searched***, ***added***, ***updated***, ***deleted***, ***printed***, ***listed*** etc.
    - **POS Credit Card Management Feature** such as ***Credit Card Search & Print, New Credit Card Registration***, ***Credit Card Update***, ***Credit Card Deletion***, & ***Credit Card Listing functionalities.***

  - customer reservations, rentals, returns, customer management etc., therefore fast response and performance is required to quickly service a customer and minimize the wait. This is more important in Airports and other high-traffic locations.
  - We also wanted to provide our customer service agents with a rich user-interface experience.
  - The system in the agencies is also used by other back-end personnel such as vehicle inventory managers and administrators, service personnel, vehicle transport drivers, etc. Therefore, the system needs to also perform well

- **Corporate Offices:**
  - The corporate offices are where the business operations are managed by business employees & employees at the rental agencies via the **INTRANET Web Portal**.
  - These features include:
    - **Intranet Web Enterprise Resource Planning Systems (ERP) Portal Feature** such as providing access to **Enterprise Resource Planning Systems (ERP) Applications** such as: ***Customer Credit Card Management System***, ***Vehicle Inventory Management System***, ***Customer Relationship Management (CRM)***, ***Human Resource Management System***, & ***Finance & Operations System, Marketing System, Customer & Field Service System etc.***
    - **Web EZRental Point-of-Sales Corporate Management System** which allow employees to ***manage*** & ***execute*** **Point-of-Sales (POS)** transactions via the **Intranet Web Poral** such as: ***Search Customer Profile Information***, ***Customer Account Management***, ***Customer Registration***, ***Customer Update***, ***Customer Delete***, & ***Customer Listing functionalities, Manage & Make Reservations of a Vehicle***, ***Manage an existing Rental***, ***etc.***

  - The system will also perform well, but the performance requirements are not as stringent as our rental agencies for which the Corporate Web Intranet meets these requirements.

- **Customer self-service Web Portal:**
  - Customers who wish to make reservations and manage their reservations and rentals online via the internet, should be able to do so from anywhere in the world via an **INTERNET Web Portal**.
  - Features include:

    - **Web Customer Facing EZRental Point-of-Sales System** which allows customers to ***manage*** & ***execute*** **Point-of-Sales (POS)** transactions online such as **reservations** & **Profile** online via a **BROWSER** using an **Internet Web Poral**. This includes functionality such as ***Search Customer Profile Information***, ***Customer Account Management***, ***Customer Registration***, ***Customer Update***, ***Customer Delete***, & ***Customer Listing functionalities, Manage & Make Reservations of a Vehicle***, ***Manage an existing Rental***, ***etc.***

  - The system should also have good user-experience and performance.

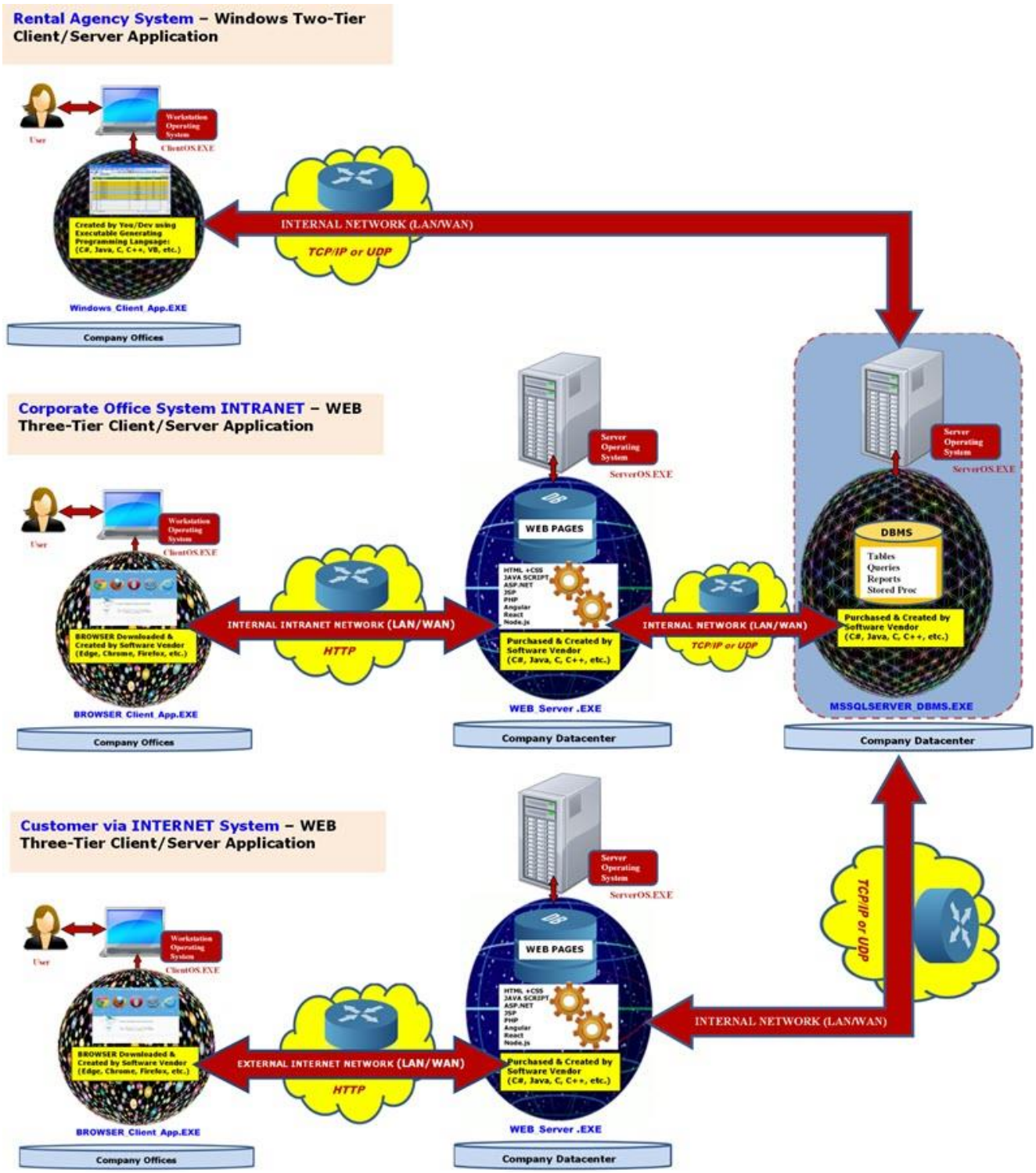
- Based on the above requirements and ideation, the derived target applications architecture and components are as follows:

Rental Agency Two-Tiered Windows Desktop Client/Server Application – Front-line workers such as customer service desk in store branches, airports etc., in addition to other support personnel such as service centers employees, inventory etc., are to use this Windows-based client application for speed and performance.

Corporate Office Three-Tiered Web-based Client/Server – This Web Application named EZRentalCorp.com, targeted for corporate business users in the corporate offices to manage the day-to-day business activities of our business and office workers personnel via a Browser Application.

Customer Internet Three-Tiered Web-based Client/Server – This Web Application named EZRental.com, targeted for customers who will reserve vehicles online via a Browser Application

- Below is a pictorial diagram of this multi-component client/server architecture. Note that both the **Windows Desktop Client Application**, the **Corporate Office Browser Web Client Applications**, and the **Customer Internet Browser Web Client Application** are all sharing the same **Microsoft SQL Server DBMS Server Application**:



Physical Architecture Hardware & Software Inventory

- The list of hardware and software we purchased/downloaded is shown in the table below.

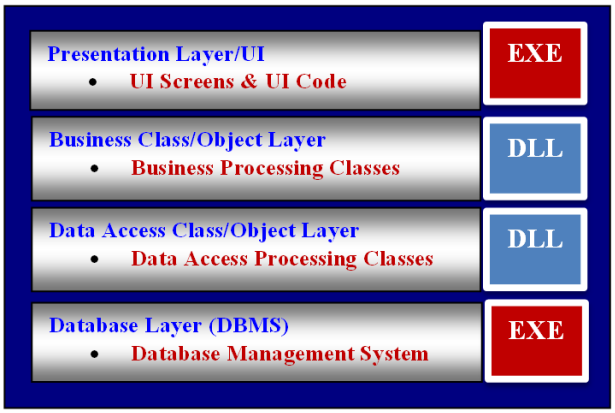
Architecture Component	Hardware Purchase & Inventory	Software Purchase & Inventory
Rental Agency Windows Client/Server Infrastructure	**User Desktop/Laptop Computer:** ▪ As needed, purchase/upgrade Memory, Processor, Hard disk etc., only if PCs need to be upgraded to support the Windows Client application. **Network Hardware:** ▪ Required Switches, Routers & other network peripherals required to support the networking requirements of the application. **Office Desktop/Laptop Installation:** ▪ Assemble team to install the Windows Client Application to user's computers or use Computer Management Tool to package and deploy the applications to the user's computers.	**User Desktop/Laptop Operating System:** ▪ Target OS – Windows 10, MAC Os etc. **Application Development & Framework:** ▪ Purchase/download required Application Development Tools such as Visual Studio, Eclipse, NetBeans etc., to develop the Windows Client Application. ▪ Download/Purchase any required framework for developing the Windows Client Application.
Corporate Office Intranet Web Client/Server Infrastructure	**Physical Server:** ▪ 1 Physical Server Computer with required specifications. **Network Hardware:** ▪ Required Switches, Routers & other network peripherals. **Datacenter Hardware Installation:** ▪ Required racks, cooling, electrical and other hardware to support installation of physical servers, etc.	**Server Operating System:** ▪ Target OS – Windows Server, Linux, Unix, etc. **Web Server Application:** ▪ Purchase/download target Web Server Application such as MSFT IIS, Apache, other. **Web Development Framework:** ▪ Purchase/download required Web Development Tools ▪ Purchase/download required web development framework such as React, Angular, ASP.NET etc.
Customer Facing Internet Web Client/Server Infrastructure	**Physical Server:** ▪ 1 Physical Server Computer with required specifications. **Network Hardware:** ▪ Required Switches, Routers & other network peripherals. **Datacenter Hardware Installation:** ▪ Required racks, cooling, electrical and other hardware to support installation of physical servers, etc.	**Server Operating System:** ▪ Target OS – Windows Server, Linux, Unix, etc. **Web Server Application:** ▪ Purchase/download target Web Server Application such as MSFT IIS, Apache, other. **Web Development Framework:** ▪ Purchase/download required Web Development Tools ▪ Purchase/download required web development framework such as React, Angular, ASP.NET etc.

Shared Database Management System Infrastructure for Agency Two-Tier Client Server, Office, and Customer Web Portals	**Physical Server:** ▪ 1 Physical Server Computer with required specifications. **Network Hardware:** ▪ Required Switches, Routers & other network peripherals. **Datacenter Hardware Installation:** ▪ Required racks, cooling, electrical and other hardware to support installation of physical servers, etc.	**Server Operating System:** ▪ Target OS – Windows Server, Linux, Unix, etc. **Database Management System Application:** ▪ Purchase/download target DBMS Server Application, which in this case is either **Microsoft SQL Server** ▪ Purchase/download the **DBMS Dev & Admin tools** such as **MS SQL Server Management Studio** for **Microsoft DBMS**

Rental Agency Two-Tiered Windows Desktop Client/Server Application

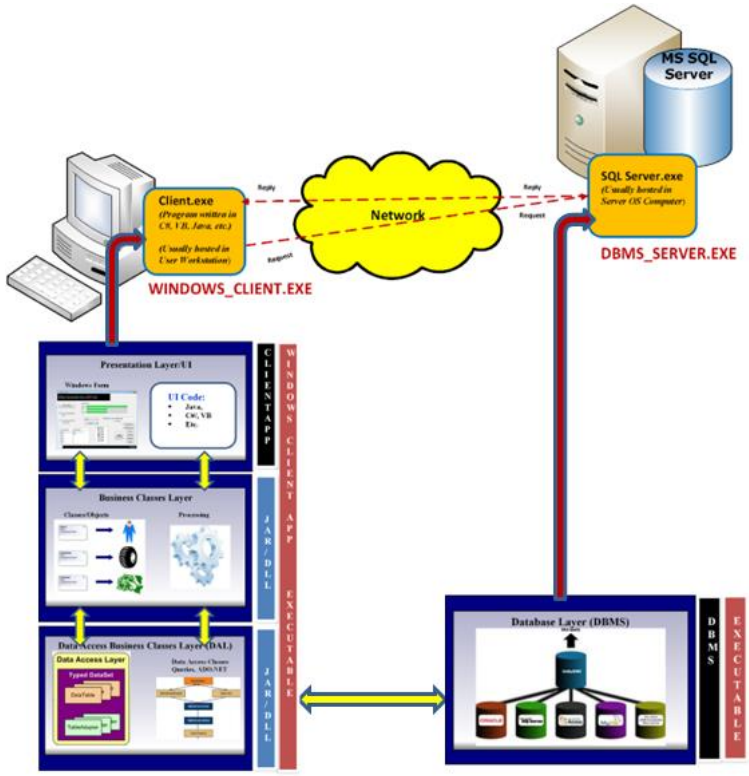
- For the Rental Agencies **Two-Tiered Windows Desktop Client/Server Application** we used the scalable **Four-Layer Windows Client/Server Software Programming Architecture**:

4 Tiers Windows Client/Server Application Architecture

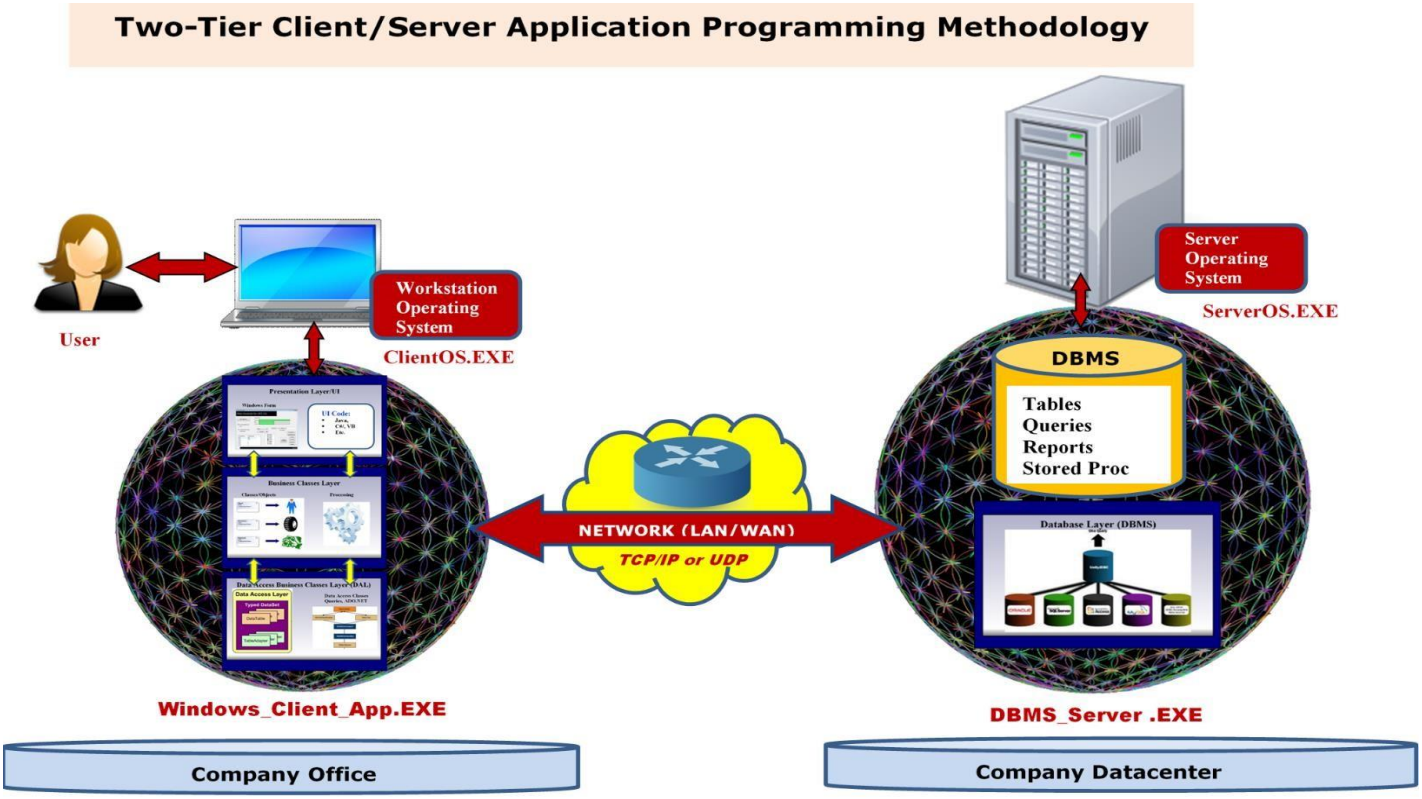


- The layers were programed as shown below as a **Windows Desktop FAT CLIENT Application** requesting database services from the **Database Management System Application**:

- High-level view of software architecture embedded within the physical architecture:



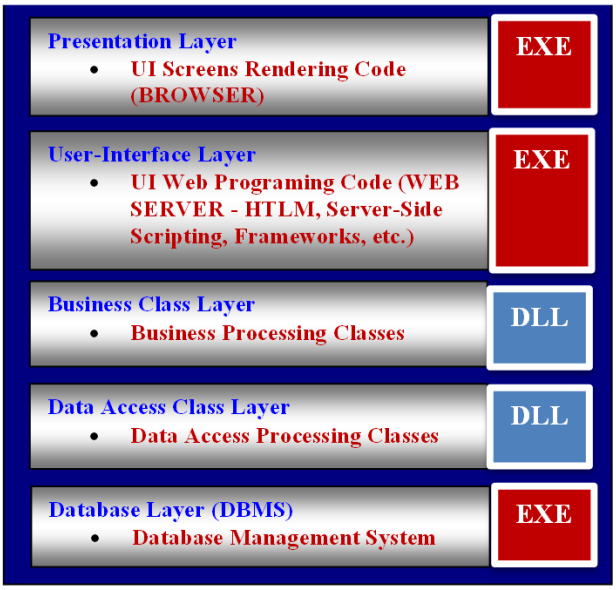
- Detailed view of software architecture embedded within the physical architecture:



Corporate Office Three-Tiered Web-based Client/Server Application

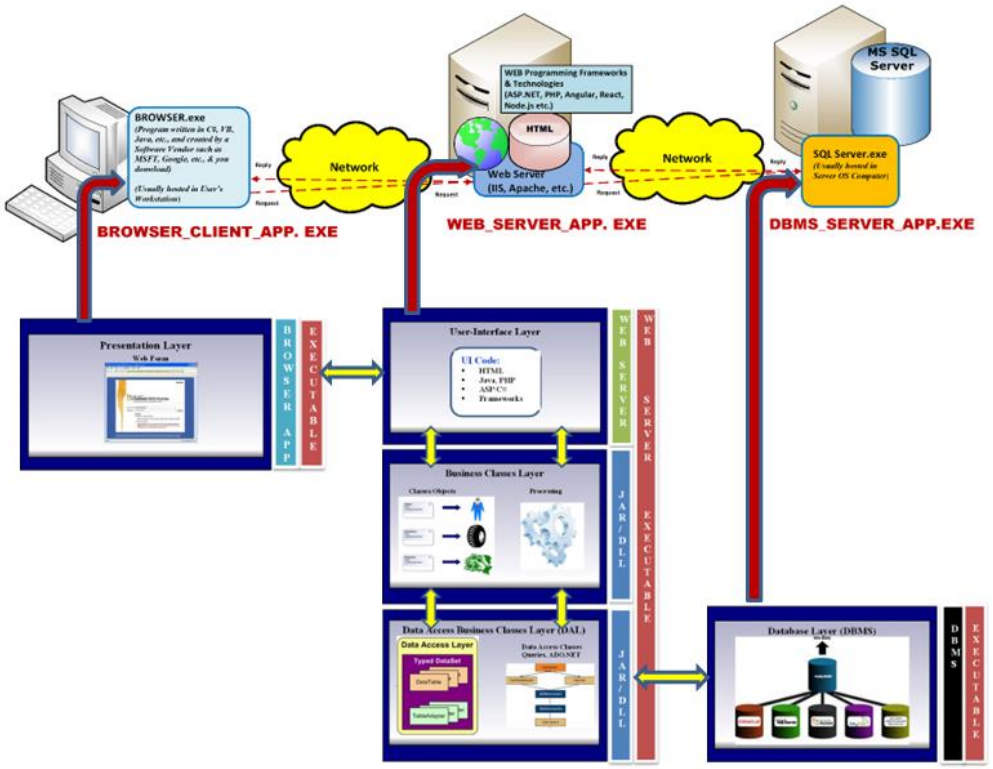
For the ***Corporate Offices*** **INTRANET (internal corporate network) Portal Three-Tiered Web-based Client/Server Application** we will use the scalable **Five-Layer Web Client/Server Software Programming Architecture**:

5 Tiers Web Client/Server Application Architecture

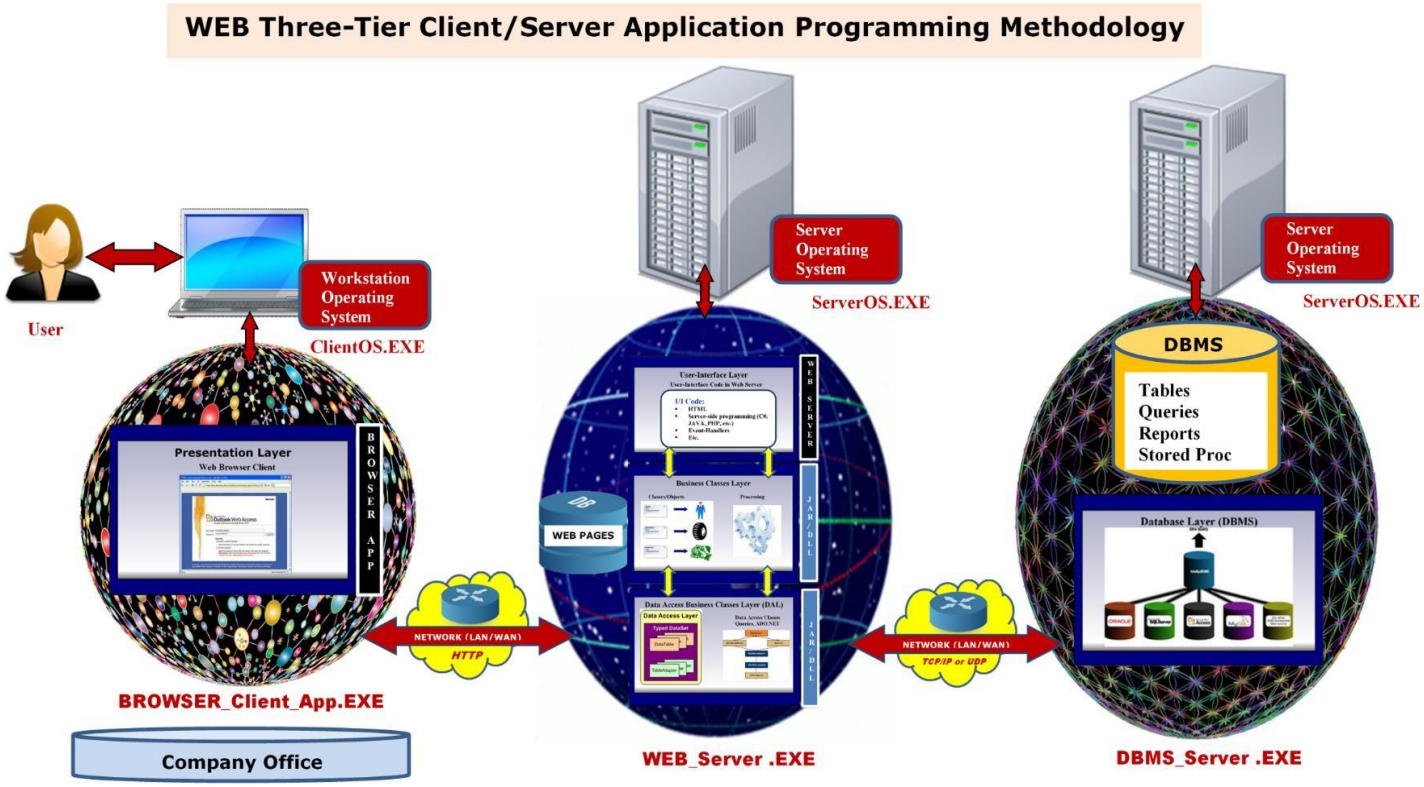


- The layers were programed as shown below with a **THIN CLIENT BROWSER Application** requesting web services from a **Web Server Application** and the **Web Server Application** requesting database services from the **Database Management System Application**:

High-level view of software architecture embedded within the physical architecture:



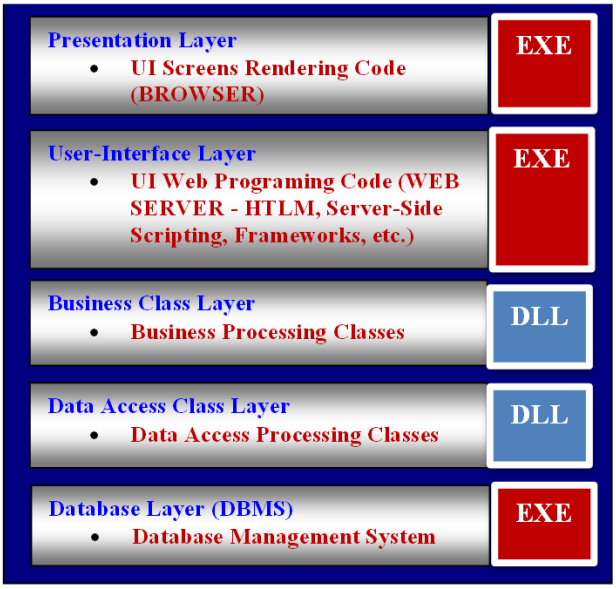
- Detailed view of software architecture embedded within the physical architecture:



Customer Facing Internet Three-Tiered Web-based Client/Server

- For the ***Customer Facing*** **INTERNET (public world-wide web network) Portal** **Three-Tiered Web-based Client/Server Application** we will also use the scalable **Five-Layer Web Client/Server Software Programming Architecture**:

5 Tiers Web Client/Server Application Architecture

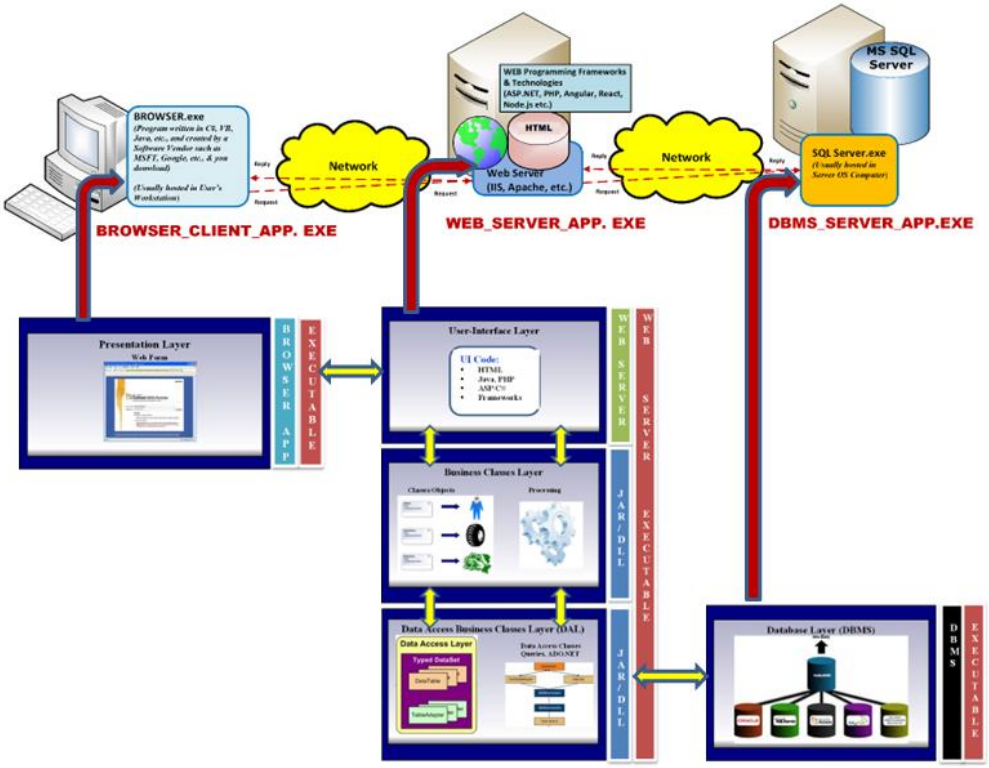


  - **Due to the nature of Web Development and advances in Web Technology Frameworks**, we will consider leveraging **Third-Pary Frameworks** for the following Layer in the **Web Server Application**:

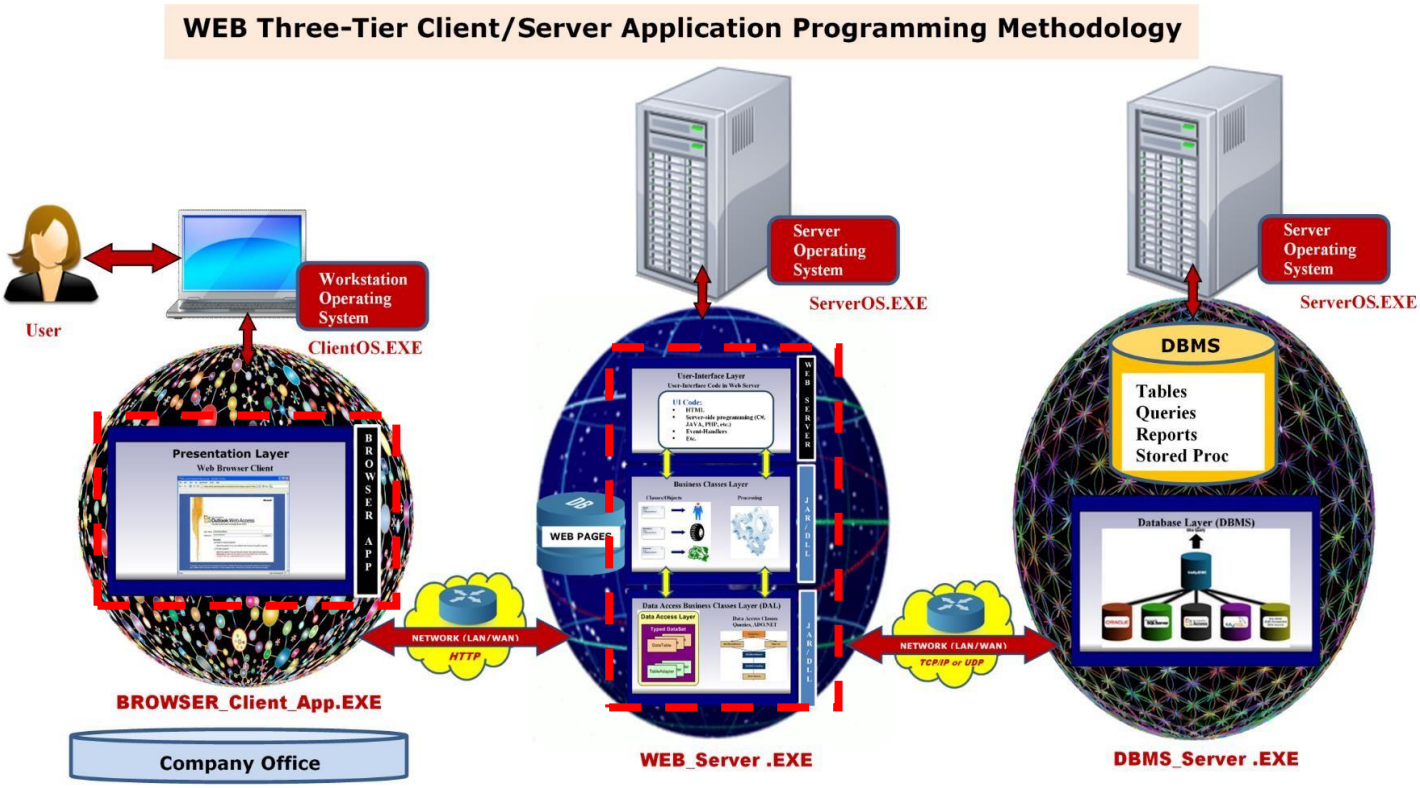
  - These can include any of the following **frameworks and technologies**:

- The layers will be programed as shown below with a **THIN CLIENT BROWSER Application** requesting web services from a **Web Server Application** and the **Web Server Application** requesting database services from the **Database Management System Application**:

- High-level view of software architecture embedded within the physical architecture:



- Detailed view of software architecture embedded within the physical architecture:



Application Development Features and Functionalities (Agile Backlog)

This section explains the list of features that have been implemented for this project.During the analysis meeting with the business stakeholders it was decided that this application would have ten features.

Feature #	Feature Description
FEATURE #1A	**FEATURE #1A – EZRental Rental Agency Point-of-Sales (POS) System CUSTOMER SERVICE – CUSTOMER MANAGEMENT SYSTEM:** ▪ **WINDOWS CLIENT POINT-OF SALES SYSTEM** – *WINDOWS UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING* features used by ***customer service representative employees*** via the *Point-of-Sales computer* machine in the *Rental Agencies* to service customer's **CUSTOMER MANAGEMENT** requests or transactions. ▪ The following are features and functionality that are required for this application feature: ○ **POS Customer Management Feature:** **POS Customer Management (Retail Customer & Corporate Customer) features** such as *Customer Search & Print, New Customer Registration, Customer Update, Customer Deletion, & Customer Listing functionalities*. ○ **Note that each transaction is saved to database immediately after execution:** - **Feature UI Form Requirements:** *Design & programming* of required *User-Interface Forms & GUI Controls* to support this feature. - **Feature Processing Requirements:** *Design & programming* of required ***Object-Oriented (OOP) Processing & Logic*** to support this feature. ▪ This feature is designed only to be used by customer service agents and other employees using the **Windows Two-Tiered Client/Server Application** in the **Rental Agencies**.
FEATURE #1B	**FEATURE #1B – EZRental Rental Agency Point-of-Sales (POS) Customer Management System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Feature #	Feature Description
FEATURE #2A	**FEATURE #2A – EZRental Rental Agency Point-of-Sales (POS) System CUSTOMER SERVICE VEHICLE RESERVATION, RENTAL & RETURN FEATURE MANAGEMENT:** ▪ **WINDOWS CLIENT POINT-OF SALES SYSTEM** – *WINDOWS UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING* features used by ***customer service representative employees*** via the *Point-of-Sales computer* machine in the *Rental Agencies* to service customer's **CUSTOMER VEHICLE RESERVATION, RENTAL & RETURN MANAGEMENT,** or transactions. ▪ The following are features and functionality that are required for this application feature: ○ **POS Vehicle Reservation, Rental & Return Management Feature:** **POS Customer Vehicle Reservation, Rental & Return Management (Retail Customer & Corporate Customer) features** such as *Vehicle Reservations, Vehicle Rental & Vehicle Return functionalities:* - **Feature UI Form Requirements:** *Design & programming* of required *User-Interface Forms & GUI Controls* to support this feature. - **Feature Processing Requirements:** *Design & programming* of required ***Object-Oriented (OOP) Processing & Logic*** to support this feature. ▪ This feature is designed only to be used by customer service agents and other employees using the **Windows Two-Tiered Client/Server Application** in the **Rental Agencies**.
FEATURE #2B	**FEATURE #2B – EZRental Rental Agency Point-of-Sales (POS) Customer Vehicle Reservation, Rental & Return Management System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Feature #	Feature Description
FEATURE #3A	**FEATURE #3A – EZRental Internal Back-Office Agency BACK-OFFICE VEHICLE INVENTORY MANAGEMENT SYSTEM (NOT A CUSTOMER FACING APPLICATION):** ▪ **WINDOWS CLIENT POINT-OF SALES SYSTEM** – ***WINDOWS UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING*** features used by **Back-Office Inventory Team employees** via a **computer machine** in the ***Rental Agencies*** to service inventory needs for **VEHICLE INVENTORY MANAGEMENT,** or transactions. ▪ This is a unique Back-end system meant for inventory team employees to perform bulk **IN-MEMORY** inventory processing or management tasks on vehicles such as: ***adding*** vehicles to the system, ***searching*** for vehicles, ***updating*** vehicles, ***deleting*** vehicles, etc. The idea is that the employee can perform all these features on their computer **in-memory** repeatedly for several vehicles in one session saving to database after each transaction but managed in-memory using a **collection** or **other data structure** to manage it locally. When user is done with all inventory transactions, all transactions have been saved to database but, is still locally in the collection or other data structure and can be updated as needed. By keeping it locally in memory, the operations are faster. ▪ The following are features and functionality are required for this application feature: o **POS Vehicle Inventory Management Feature:** **POS Vehicle Inventory Management features** allows inventory personnel and employees to bulk-manage vehicles such as **Cars**, **SUVs, Mini-Vans**, ***Cargo Vans,*** and other vehicles to be ***searched***, ***added***, ***updated***, ***deleted***, ***printed***, ***listed*** etc. - **Feature UI Form Requirements:** ***Design & programming*** of required ***User-Interface Forms & GUI Controls*** to support this feature. - **Feature Processing Requirements:** ***Design & programming*** of required ***Object-Oriented (OOP) Processing & Logic*** to in the to support this feature. ▪ This back-office features are not designed to be used by customers and not available via the Web and implemented using the **Windows Two-Tiered Client/Server Application** in the **Rental Agencies**.
FEATURE #3B	**FEATURE #3B – EZRental Rental Agency Vehicle Inventory Management System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – ***BACK-END DATABASE DESIGN & FEATURES*** **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Feature #	Feature Description
FEATURE #4A	**FEATURE #4A – EZRental Rental Agency Point-of-Sales (POS) BACK-OFFICE CREDIT CARD MANAGEMENT SYSTEM:** ▪ **WINDOWS CLIENT POINT-OF SALES SYSTEM** – ***WINDOWS UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING*** features is a **back-end system** used by ***customer service representative & other employees*** via the ***Point-of-Sales computer*** machine in the ***Rental Agencies*** to service customer's **CREDIT CARD MANAGEMENT,** or transactions required when servicing customers. ▪ The following are features and functionality that are required for this application with features such as: o **POS Credit Card Management Feature: POS Customer Credit Card Management features** such as ***Credit Card Search & Print, New Credit Card Registration, Credit Card Update, Credit Card Deletion, & Credit Card Listing functionalities:*** - **Feature UI Form Requirements:** ***Design & programming*** of required ***User-Interface Forms & GUI Controls*** to support this feature. - **Feature Processing Requirements:** ***Design & programming*** of required ***Object-Oriented (OOP) Processing & Logic*** to support this feature. ▪ This feature is designed only to be used by customer service agents and other employees using the **Windows Two-Tiered Client/Server Application** in the **Rental Agencies**.
FEATURE #4B	**FEATURE #4B – EZRental Rental Agency Point-of-Sales (POS) Credit Card Management System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – ***BACK-END DATABASE DESIGN & FEATURES*** **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Feature #	Feature Description
FEATURE #5A	**FEATURE #5A – EZRental Rental Agency Point-of-Sales (POS) System BACK-OFFICE EMPLOYEE & CUSTOMER USER-ACCOUNT MANAGEMENT SYSTEM:** ▪ **WINDOWS CLIENT POINT-OF SALES SYSTEM** – *WINDOWS UI FORM(S) BACK-OFFICE APPLICATION & OOP PROGRAMMING* **User-Accounts Management Features** used by ***customer service representative & IT Administrator employees*** via the *Point-of-Sales computer* machine in the *Rental Agencies* to service customer's **CUSTOMER & EMPLOYEE USER ACCOUNT MANAGEMENT** requests or transactions. ▪ **Employee User Accounts** – These are the user accounts used by *IT Administrators*, *Customer Service Employees*, *back-office employees*, and *any employee who qualifies* for access to the system. ▪ **Customer User Accounts** – These are the user accounts used by *IT Administrators*, *Customer Service Employees*, *back-office employees* and any *employee* who has access to the system to *manage* the **Customer User Accounts** for login into the **Customer Web Portal**. ▪ The following are features and functionality that are required for this application feature: o **POS User Account (Employee & Customer) Management Feature:** **POS User Account Management (Employee & Customer) features** such as: - **Employee User Account Feature 5A-1** – Allows *IT Administrators*, *Customer Service Employees*, *back-office employees*, and *any employee who qualifies* to *manage* employee user accounts that allow employees to login into the POS System. And perform the following tasks: ***Employee User Account Search by username, New Employee User Account Registration, Employee User Account Update by username, Employee User Account Deletion by username, & Employee User Account Listing functionalities***. **IMPORTANT!** Note that the **password** is ***NEVER DISPLAYED or LISTED***, only the **username**! - **Customer User Account Feature 5A-2** – Allows *IT Administrators*, *Customer Service Employees*, *back-office employees*, and *any employee who qualifies* to *manage* customer user accounts that allow customers to login into the **Customer Web Portal System**. And perform the following tasks: ***Customer User Account Search by username, New Customer User Account Registration, Customer User Account Update by username, Customer User Account Deletion deletion by username, & Customer User Account Listing functionalities***. **IMPORTANT!** Note that the **password** is ***NEVER DISPLAYED or LISTED***, only the **username**! o ***Note that each transaction is saved to database immediately after execution:*** - **Feature UI Form Requirements:** ***Design & programming*** of required ***User-Interface Forms & GUI Controls*** to support this feature. - **Feature Processing Requirements:** ***Design & programming*** of required ***Object-Oriented (OOP) Processing & Logic*** to support this feature. ▪ This feature was designed only to be used by ***IT Administrations*** and other employees who qualify to use this system to manage both employees & customers user accounts using the **Windows Two-Tiered Client/Server Application** in the **Rental Agencies**.

FEATURE #5B	**FEATURE #5B – EZRental Rental Agency Point-of-Sales (POS) User EMPLOYEE User Account Management System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* (Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature to store and manage **EMPLOYEE USER ACCOUNTS**.
FEATURE #5C	**FEATURE #5C – EZRental Rental Agency Point-of-Sales (POS) User CUSTOMER User Account Management System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* (Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature to store and manage **CUSTOMER USER ACCOUNTS**.

Feature #	Feature Description
FEATURE #6A	**FEATURE #6A – EZRental Rental Agency Point-of-Sales (POS) System EMPLOYEES BACK-OFFICE SECURITY LOGIN AUTHENTICATION SYSTEM:** ▪ Proper ***security and authentication*** must be implemented to make sure only authorized **employees** can access the **Point-0f- Sales & Back-End Management systems** when they **login** into the **Windows Two-Tiered Client/Server Application** & **Web Three-Tiered Corporate Client/Server Application**. ▪ **WINDOWS CLIENT POINT-OF SALES SYSTEM** – ***WINDOWS UI FORM(S) BACK-OFFICE APPLICATION & OOP PROGRAMMING*** **Login Authentication features** used by ***customer service representative & IT Administrator employees*** via the ***Point-of-Sales computer*** machine in the ***Rental Agencies*** to service employee **LOGIN AUTHENTICATION SYSTEM**. ▪ The following are features and functionality that are required for this application such as: o **POS Employee Back-Office Security Login Authentication System:** **POS Login Authentication Access for Employees features** such as: - **Employee Authentication Feature 6A-1** – To have access to the application, an employee (Customer Service Reps, Back-office employee etc.) must provide a **username & password**. This feature is required to be ***designed*** & ***programmed*** into the application. - **Employee Authentication Feature 6A-2** – ***Design & programming*** of required **User-Interface Forms** & **GUI Controls** to support the **Authentication System feature**! o Programming includes: - **Feature UI Form Requirements:** ***Design & programming*** of required ***User-Interface Forms & GUI Controls*** to support this feature. - **Feature Processing Requirements:** ***Design & programming*** of required ***Object-Oriented (OOP) Processing & Logic*** to support this feature. ▪ This feature is designed only to be used by all employees wishing access to the **Windows Two-Tiered Client/Server Application POS System** in the **Rental Agencies**.
FEATURE #6B	**FEATURE #6B – EZRental Rental Agency Point-of-Sales (POS) Employee Back-Office Security Login Authentication System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – ***BACK-END DATABASE DESIGN & FEATURES*** **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Feature #	Feature Description
FEATURE #7A	**FEATURE #7A – EZRental INTERNAL CORPORATE EMPLOYEE & RENTAL AGENCIES EMPLOYEES INTRANET CORPORATE BUSINESS APPLICATIONS WEB PORTAL:** ▪ This **INTRANET (NOT THE PUBLIC INTERNET) Web Portal** EZRentalHub.com, is a **Web-based Three-Tiered Client/Server physical & Software Development Architecture** used by **CORPORATE & OTHER EMPLOYEES** to *execute* **Enterprise Resource Planning Systems (ERP) Applications & other Corporate Applications** online intranet via a **BROWSER**. ▪ **BROWSER/INTRANET WEB ERP & CORPORATE APPLICATION SYSTEM** – *WEB UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING* **Enterprise Resource Planning Systems (ERP) Applications & other Corporate Applications Features** used by ***Corporate Employees*** via the **CORPORATE INTRANET** *PORTAL*. ▪ The following are features and functionality that are required for this **INTRANET WEB APPLICATION**: o **Corporate Business Application Intranet Web Portal Features:** - **Intranet Web Enterprise Resource Planning Systems (ERP) Portal Feature 7A-1 –** Provides access to **Enterprise Resource Planning Systems (ERP) Applications** such as: *Customer Credit Card Management System, Vehicle Inventory Management System, Customer Relationship Management (CRM), Human Resource Management System, & Finance & Operations System, Marketing System, Customer & Field Service System etc.* - **Web EZRental Point-of-Sales Corporate Management Feature 7A-2 –** Allows Employees to ***manage*** & ***execute*** **Point-of-Sales (POS)** transaction via the **Intranet Web Poral** such as: *Search Customer Profile Information, Customer Account Management, Customer Registration, Customer Update, Customer Delete, & Customer Listing functionalities, Manage & Make Reservations of a Vehicle, Manage an existing Rental, etc.* o Programming includes: - **Feature UI Form Requirements:** *Design & programming* of required ***INTRANET WEB*** *User-Interface Forms & GUI Controls* to support this feature. - **Feature Processing Requirements:** *Design & programming* of required ***INTRANET WEB TECHONLOGY***, ***Object-Oriented (OOP) Processing & Logic PROCESSING*** to support this feature. ▪ This feature is designed only to be used by ***CORPORATE EMPLOYEES*** in the **Corporate Offices** & ***RENTAL AGENCIES EMPLOYEES*** via the **INTRANET** using the **Web Three-Tiered Client/Server Application**.
FEATURE #7B	**FEATURE #7B – EZRental Corporate Employee & Rental Agencies Employees INTRANET WEB PORTAL System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

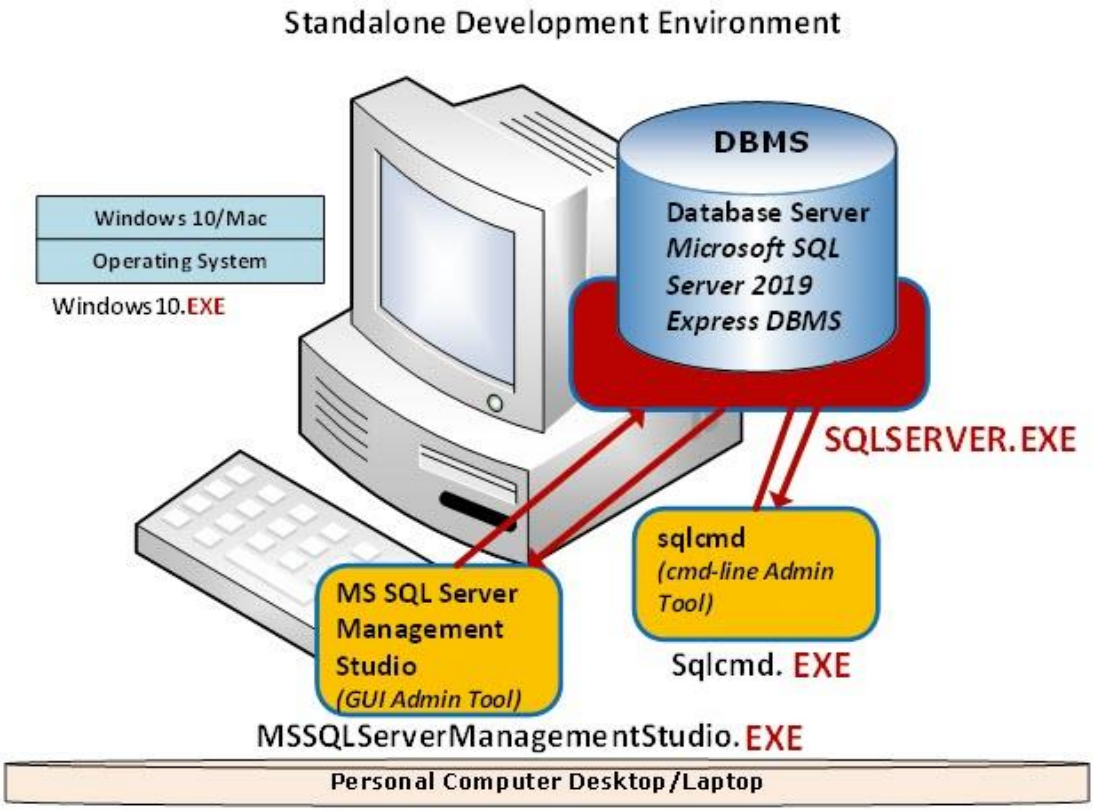
Feature #	Feature Description
FEATURE #8A	**FEATURE #8A – EZRental EXTERNAL CUSTOMER SELF-SERVICE INTERNET CUSTOMER FACING POINT-OF-SALES (POS) WEB PORTAL:** ▪ This **Web Portal** EZRental.com, is a **Web-based Three-Tiered Client/Server physical & Software Development Architecture** used by **CUSTOMERS** to *manage* & *make* **reservations** online via a **BROWSER**. ▪ **BROWSER/WEB CUSTOMER POINT-OF SALES SYSTEM** – *WEB UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING* **Point-of-Sales (POS) Management Features** used by ***customers*** via the **INTERNET** *Point-of-Sales PORTAL* via their computers/laptop/tables/Mobile to **MAKE RESERVATIONS ONLINE & MANAGE THEIR RENTAL**. ▪ The following are features and functionality that are required for this **WEB APPLICATION** feature: o **POS Reservation & Management Features:** - **Web POS Authentication System Feature 8A-1** – Proper **security and authentication** must be implemented to make sure **only the authorized customer can access to its Point-0f-Sales portal and login and out of their profile website**. - **Web POS Customer Self-Service Management Feature 8A-2** – Allows POS Customer (Retail Customer & Corporate Customer) Self-Service Management of their account such as: *Customer Profile Information, Customer Account & Login Registration, Customer Update Profile, Customer Delete Profile, & Customer Listing functionalities such as listing of Reservations & Rental History etc.* - **Web POS Customer Self-Service Point-of-Sales Management Feature 8A-3** – Allows POS Customer (Retail Customer & Corporate Customer) Self-Service features to make reservations and manage rentals such as: *Make Reservations of a Vehicle, Manage an existing Rental, etc.* - **Web POS User Account Management Feature 8A-4** – Allows POS Customer (Retail Customer & Corporate Customer) Self-Service features to enable customer to manage its **User Account** and perform the following operations: *Reset Username & Reset Password.* o Programming includes: - **Feature UI Form Requirements:** *Design & programming* of required ***WEB*** *User-Interface Forms & GUI Controls* to support this feature. - **Feature Processing Requirements:** *Design & programming* of required ***WEB TECHONLOGY***, ***Object-Oriented (OOP) Processing & Logic PROCESSING*** to support this feature. ▪ This feature is designed only to be used by ***CUSTOMERS*** via the **INTERNET** using the **Web Three-Tiered Client/Server Application** from their **Personal Computer/Mobile Devices via the INTERNET**.
FEATURE #8B	**FEATURE #8B – EZRental Customer Serf-Service internet Customer facing Point-of-Sales (POS) WEB PORTAL System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Feature #	Feature Description
FEATURE #9A	**FEATURE #9A – EZRental Customer Point-of-Sales (POS) System CUSTOMER FACING WEB PORTAL SECURITY LOGIN AUTHENTICATION SYSTEM:** ▪ Proper ***security and authentication*** must be implemented to make sure only authorized **customers** can access their **Self-Service-Point-Of-Sales Web Portal systems** when they **login** into the **Web Three-Tiered Customer Client/Server Application** via the **INTERNET**. ▪ **CUSTOMER SELF-SERVICE POINT-OF SALES SYSTEM** – *WEB UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING* for **Customer Login Authentication features** used by ***customer service representative & IT Administrator employees*** to service **CUSTOMER LOGIN AUTHENTICATION SYSTEM**. ▪ The following are features and functionality that are required for this application such as: o **Customer Self-Service Web Portal Security Login Authentication System.** **Self-Service Web Portal Login Authentication Access for Customer features** such as: - **Customer Authentication Feature 9A-1** – To have access to their Self-Service Web Portal Application, a customer must provide a **username & password**. This feature is required to be ***designed*** & ***programmed*** into the application. - **Customer Authentication Feature 9A-2** – *Design & programming* of required **Web User-Interface Forms** & **GUI Controls** to support the **Web Portal Authentication System feature**! o Programming includes: - **Feature Web UI Form Requirements:** *Design & programming* of required *User-Interface Forms & GUI Controls* to support this feature. - **Feature Web Processing Requirements:** *Design & programming* of required ***Object-Oriented (OOP) Processing & Logic*** to support this feature. ▪ This feature is designed only to be used by customers wishing access to their **Self-Service Web Portal Three-Tiered Client/Server Application** via the **INTERNET**.
FEATURE #9B	**FEATURE #9B – EZRental Customer Point-of-Sales (POS) System CUSTOMER FACING WEB PORTAL SECURITY LOGIN AUTHENTICATION SYSTEM Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support the CUSTOMER facing authentication features.**

Feature #	Feature Description
FEATURE #10A	**FEATURE #10A – EZRental INTERNAL CORPORATE EMPLOYEE & RENTAL AGENCIES EMPLOYEES INTRANET BACK-OFFICE VEHICLE TANSPORT MANAGEMENT SYSTEM WEB PORTAL:** ▪ This **INTRANET Web Portal** EZRentalHub.com, is a **Web-based Three-Tiered Client/Server physical & Software Development Architecture** used by **CORPORATE & AGENCY EMPLOYEES** to *manage* **Transportation of Vehicles by Employee Drivers to and from Rental Agencies, Vehicle Distribution Centers, and other Locations** via a **BROWSER**. ▪ **WEB TRANSOPORT MANAGEMENT SYSTEM APPLICATION** – *WEB UI FORM(S) FRONT-END APPLICATION & OOP PROGRAMMING* **Transport Management Features** used by ***Vehicle Transportation Managers & Drivers Employees*** to handle the day-to-day vehicle transportation process via the **CORPORATE INTRANET** *PORTAL*. ▪ The following are features and functionality that are required for this **INTRANET Transport Management WEB APPLICATION**: o **Corporate Vehicle Transport Application Intranet Web Portal Features:** - **Transport Scheduling Feature** – handle the day-to-day creating & scheduling of a pic-up & delivery (Any vehicle type) such as: *Creation of NEW Vehicle Transport Request, Vehicle Pick-up, Vehicle Drop-off & Vehicle Transport Status etc.* o Programming includes: - **Feature UI Form Requirements:** *Design & programming* of required ***INTRANET WEB*** *User-Interface Forms & GUI Controls* to support this feature. - **Feature Processing Requirements:** *Design & programming* of required ***INTRANET WEB TECHONLOGY***, ***Object-Oriented (OOP) Processing & Logic PROCESSING*** to support this feature. ▪ This feature is designed only to be used by ***CORPORATE EMPLOYEES*** in the Corporate Offices & ***RENTAL AGENCIES EMPLOYEES*** via the **INTRANET** using the **Web Three-Tiered Client/Server Application**.
FEATURE #10B	**FEATURE #10B – EZRental Corporate Vehicle Transport Application Intranet Web Portal Features System Back-end Database Design & Implementation to support this feature:** ▪ **DATABASE SERVER BACK-END SYSTEM** – *BACK-END DATABASE DESIGN & FEATURES* **(Create the Tables & Relationships, pre-populated tables, stored procedures, views, indexes etc.,) to support this feature.**

Database Management System Development Environment & Physical Architecture

The Database Management System (DBMS) in scope is the **MS SQL Server Community Edition** since this is the standard DBMS used at **EZRental Inc**. **MS SQL Server Community Edition** includes **SQLCMD command-line admin tool** computer along with **MS SQL Server Management Studio graphical admin tool** which was used to create the following database development Environment:



Project Roles & Responsibilities

This subsection describes how the roles and responsibilities of the project were divided for the development and project management team for the development and implementation of the entire application. The roles were divided into two main groups , 1) The database architects and database developers who are responsible for designing and implementing the data base and 2) the application and web developers responsible for the development and programming of the Windows and Web Applications.

Summary of the DBMS Server Application Development Roles and Responsibilities

- The **Business/Database Analyst hired by NYC** will assemble the required database development team, and the table below describes each of the roles and the individual (s) that will execute the roles:

Mr. Rodriguez	**Program Manager, AgileScrum Master & ProjectManager**	▪ Owner of the project and liaison to Manage the **EZRental Inc**., the customer. ▪ Activities include but not limited to. 1. Owner of project responsible for the success of the project. 2. Project Management 3. Scrum Master ensures the project stays on time and moves in the right direction. Clear any obstacles impeding the team's progress etc.
Consultant #1: **Mr. Rodriguez**	**Business & DatabaseAnalyst**	▪ A **Business/Database Analyst was hired by Prof. Rodriguez** that interviewed the stakeholders at **EZRental Inc**. And created the ***Business Requirements*** that will be the foundation to the database design & implementation. ▪ Activities include but not limited to: 1. Engaged in discovery activities & interview the stakeholders at **EZRental Inc**. 2. From the interview and discovery ***created*** **1) ER/EER ConceptualData Model from the business requirements & 2) Normalized Logical Model**.
Consultant #2, 3, 4 & 5 **Kino-Paul Hurylington**	**Database Developers**	▪ This role uses the Normalized Logical Model created by consultant #2 to create the Data Dictionary, Physical Schema Diagram, and Implement the Database Application forthe Auto Rental System. ▪ Activities include but not limited to: 1. Used the ***Normalized Logical Model*** created by consultant #2 to do the **following:** 1) **Created the Data Dictionary tables for each logical table targeting MS SQL Server Data Types** 2) **Created the Physical Schema Diagram**. 2. From these two deliverables, 1) **We implemented the Database Application using MS SQL SERVER** for the Auto Rental System.
Consultant #6 **Kino-Paul Hurylington**	**Database Administrator**	▪ The DB Admin, installed the DBMS, maintain, and operateed the DBMS throughoutits lifetime. ▪ Activities include but not limited to: 1. **Setup & installed MS SQL Server.** **2) Administrative tools for target DBMS**. 2. **Operated & Maintained the DBMS**.

Summary of the Windows Client & Browser Client Applications Development Project Roles and Responsibilities

- The **Application Full Stack OOP Architect/Analyst** hired by Mr. Rodriguez aligned the required application development team and the table below describes each of the roles and the individual (s) that will execute the roles:

Consultant #7 & 13 **Mr. Rodriguez**	**Full Stack Object-Oriented-Programming Architect**	▪ An Object-Oriented-Programming Architect was hired by Prof. Rodriguez to interview the stakeholders at **EZRental Inc**. and derive the **Application Technical Requirements** in addition to designing the **Class/Object Model Architecture**. This also includes the planning and designing both **Windows Client Application** and the **Web Browser Application**. ▪ Activities include but not limited to: 1. Engage in discovery activities & interview the stakeholders at **EZRental Inc**. 2. From the interview and discovery **1) Designed/Architected the Object-Oriented-Programming Class/Object Model for the Windows Client Application**. 3. **Designed/Architectet the Object-Oriented-Programming Class/Object Model for the Web Browser Application**.
Consultants #8, 9, 10, 11 & 12 **Kino-Paul Hurylington**	**Full Stack Windows Application Developers & UI/UX Client Application Developer**	▪ Object-Oriented-Programming developer to implement the **Windows Client Application** using **C# & .NET technologies** & on the database side, implement stored procedures and support the databased team as needed. ▪ Activities include but not limited to: 1. As a full-stack developer, I programmed and implemented the Object-Oriented Programming of Classes/Object Models designed by consultant #7 for the Windows Client Application using C# and **.NET Technologies**. 2. In addition, **Development of Database Stored Procedures,and other development requirements in the Back-end DBMS**. 3. From the technical requirements, **design a high-level GraphicalUser-Interface (GUID) wireframe**, & **implement the front-end UI Programming, features & functionality**
Consultant #14, 15, 16, 17 & 18 **Kino-Paul Hurylington**	**Full Stack Web Application Developer & UI/UX Web Application Developer**	▪ Object-Oriented-Programming developer to implement the **Web Browser Application** using **C# & ASP.NET technologies**. ▪ Activities included but not limited to: 1. As full stack developer, **Programmed & implemented theObject-Oriented-Programming of Class/Object Model designed by consultant #7 for the Web Browser Client Application using C# & ASP.NET Technologies**. 2. From the technical requirements, **designed a high-level Graphical User-Interface (GUID) wireframe**, & **implemented the Webfront-end UI Programming, features & functionality in the Web Server Application**

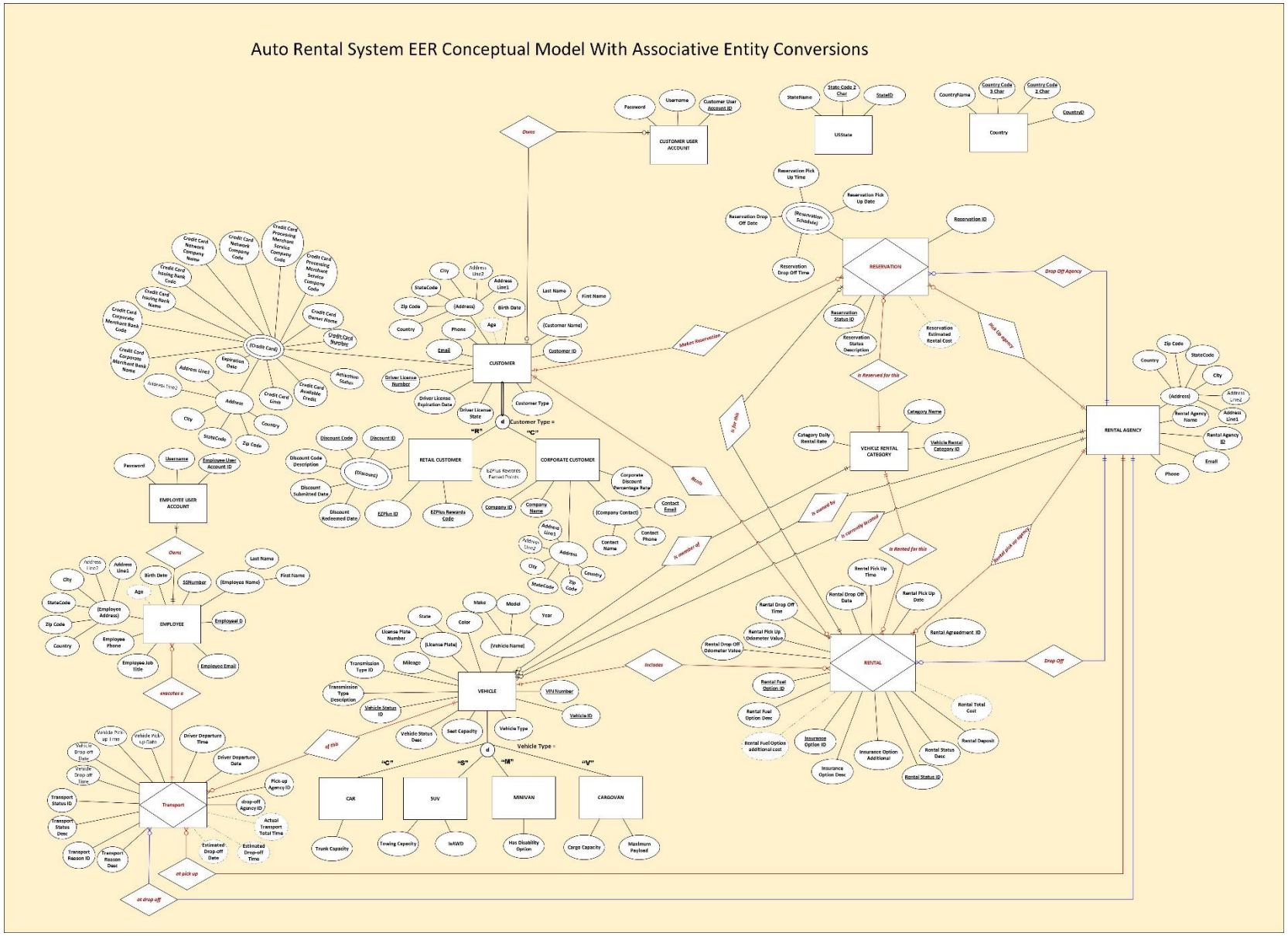
Database Design Deliverable #2 – ER/EER Conceptual Model Diagram

Our **Database Analyst/Architect** derived the **EER Conceptual Model** for the **AUTO MANAGEMENT SYSTEM**, based on the **Application Business Requirements** as part of the **Analysis Phase deliverables**.

✈ The **EER Conceptual Model Diagram** is the **foundation** of the **Database Design** for the **DBMS Auto Rental Management System Application**. Its goal is to connect the entities and relationships identified in the Application Business Requirements to build a DIAGRAM or high-level picture of how the **Application key Business data** relates.

EER Conceptual Model using Associative Entities derived from Business Requirements

Below is the **Database Analyst/Architect** rendition of the EER Model of the Business Requirements for this application, with standard CHEN notation using Associative Entities.



Database Design Deliverable #3 – Normalized Logical Model Diagram

This ***sub-section*** describes the **THIRD DATABASE DESIGN DELIVERABLE** which is the is the **Normalized Logical Model Diagram**. This **diagram** is the **First Component** of our **Waterfall Methodology DESIGN PHASE**. The **PHYSICAL MODEL DESIGN PHASE** is divided into the following 3 components which include the focus of this sub-section is the **Normalized Logical Model Diagram**:

a) The **Normalized Logical Model Diagram**.

b) The **Physical Model Data Dictionary**.

c) The **Physical Model Schema Design Diagram**.

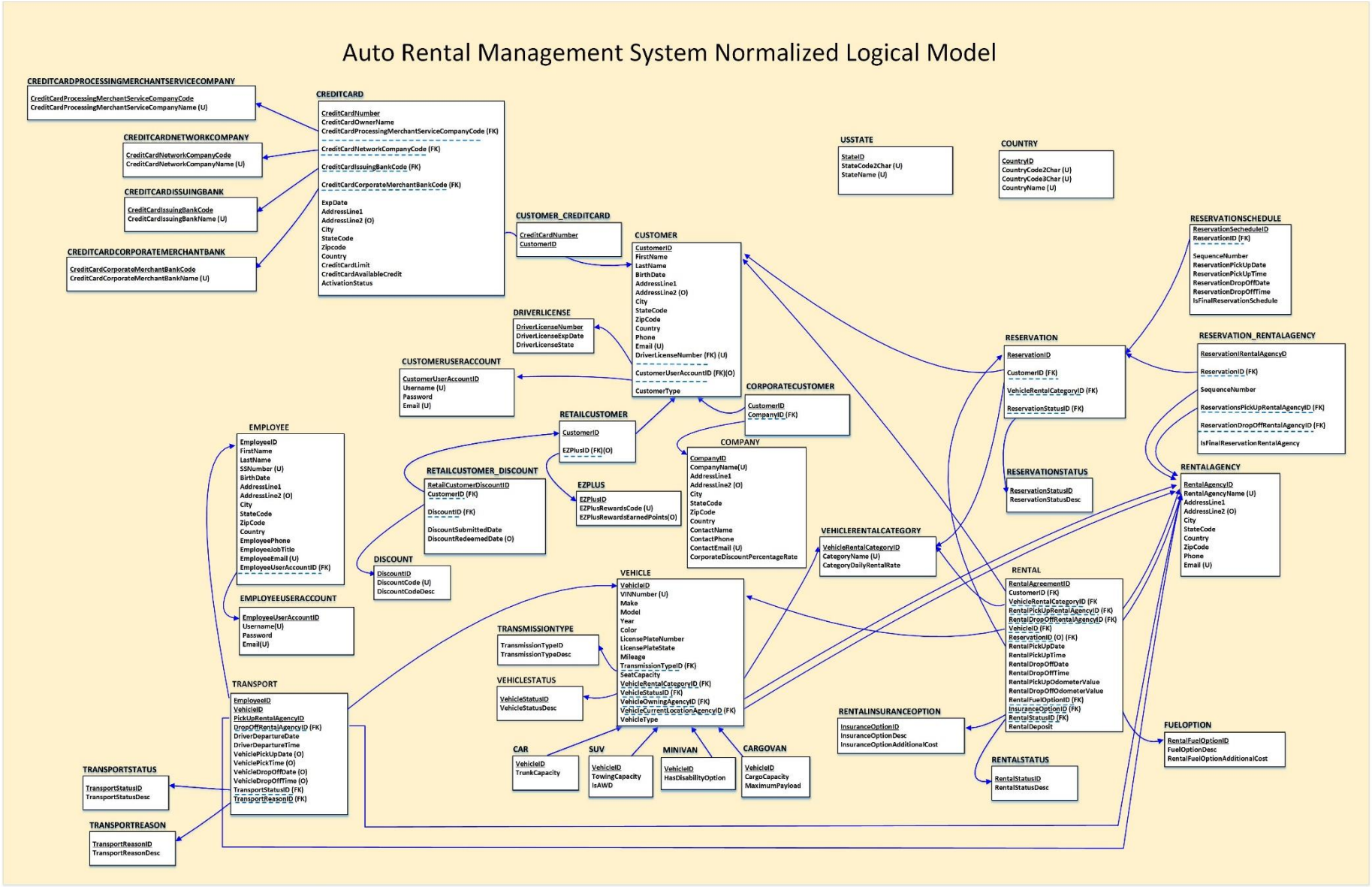
d) **Technical Specifications for performance, efficiency, data integrity, security, disaster recovery etc**.

The **Normalized Logical Model Diagram** was ***derived*** using the following **2 steps** by the **Database Analyst/Architect:**

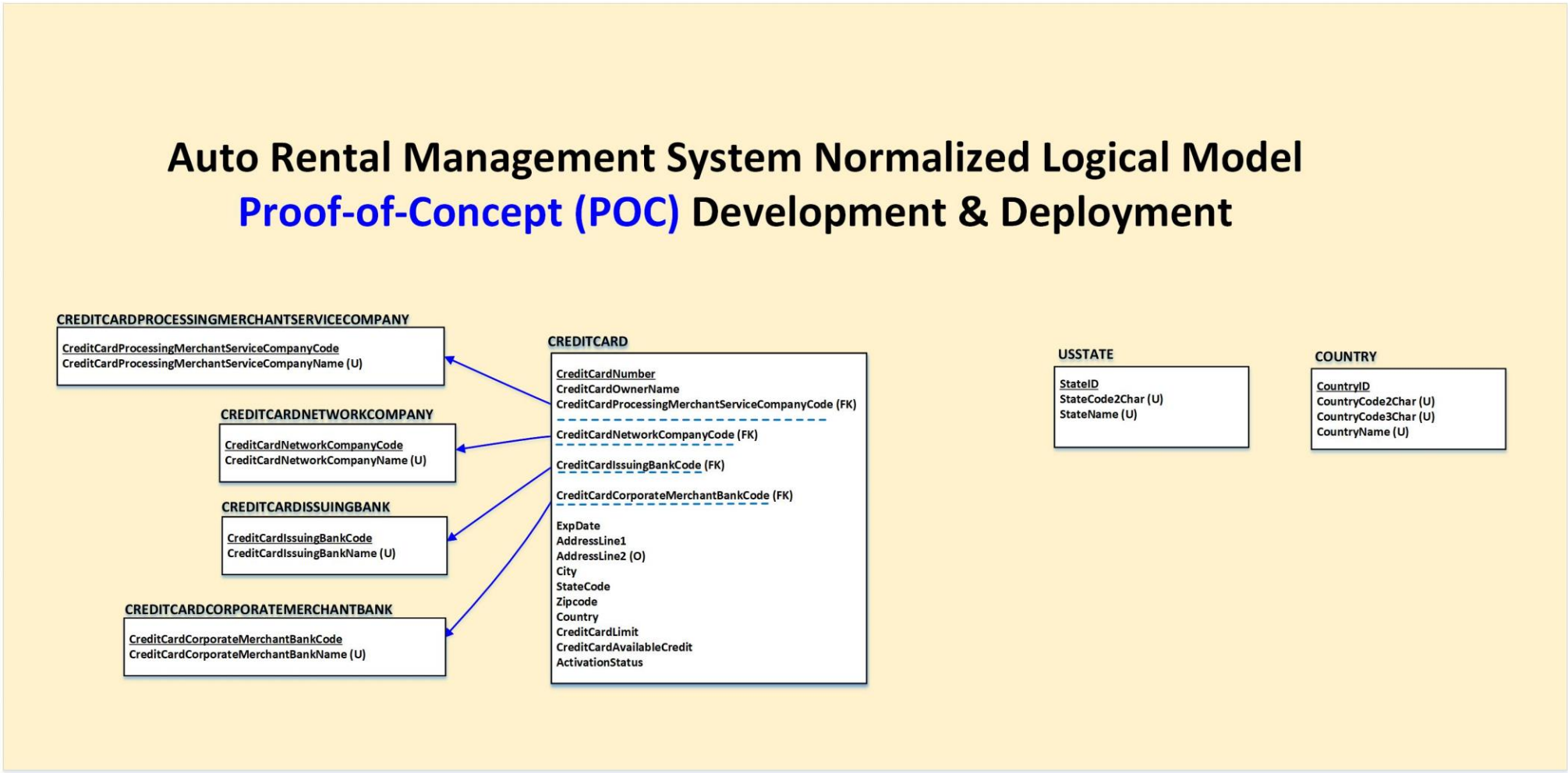
a) ***TRANSFORMED*** the **Data Modeling ER/EER Diagram** to a **Logical Model Diagram** which converts the **ER/EER Diagram** into database tables

b) *NORMALIZED* the Logical Model Diagram using the 3-Normal Forms Rules to create the Normalized Logical Model Diagram

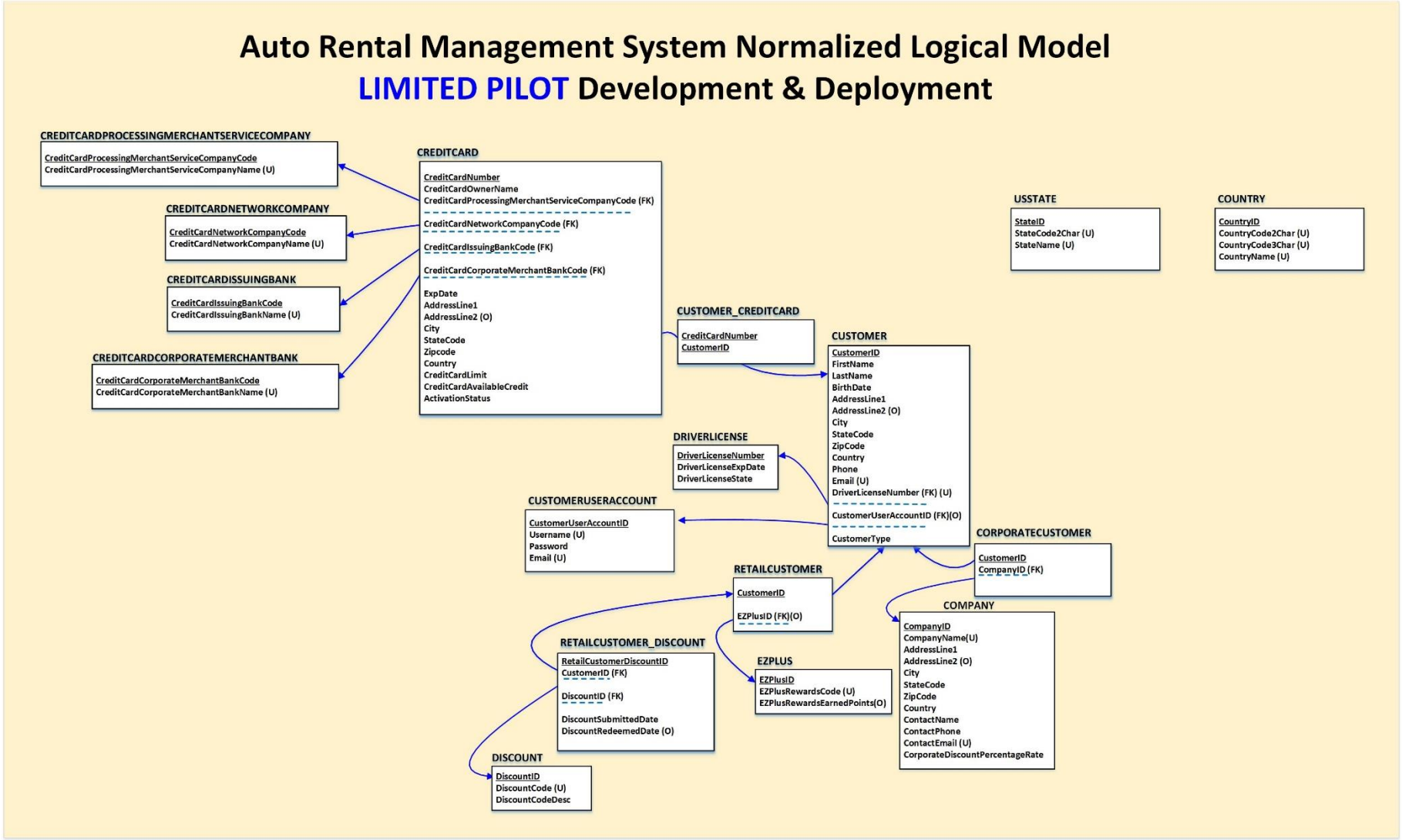
Below is the architect's rendition of the **Normalized Logical Model** based on **EER diagram** in previous section. Note there are **39 logical tables**



- Below is the **PROOF-OF-CONCEPT (POC) Normalized Logical Model** that was used to create a **PROTOTYPE** of the application to demo to the business. This diagram only contains the **7 logical tables** in scope of the **POC**:



- Below is the **LIMITED PILOT Normalized Logical Model** that was used to deploy the application to a limited number of users throughout the organization as an **MVP (Minimum Viable Product)** or product with enough features to get feedback from users before we finalized the entire application. This diagram only contains the **17 logical tables** in scope of the **PILOT**:



Database Design Deliverable #4 – Physical Model Data Dictionary

Below are populated tables for the Design & Implementation Project Document Data Dictionary. These tables contain the Attributes, MS SQL SERVER Data Type and Constraints of the 7 logical tables execute.

CreditCard Dictionary Table using **MS SQL Server DBMS** **Data Types**:

CREDITCARD							
Column Num.	Attribute/Column Name	Generic Data Type Name	**MS SQL SERVER** Data Type Name	Is it Required ?	Length /Size /Format	Constraints	Description/ purpose
1.	**CreditCardNumber**	**String**	**VARCHAR (16)**	**Yes**	**16**	**Primary Key**	***Unique Identifier*** or **Primary Key** for the CreditCard table.
2.	**CreditCardOwnerName**	**String**	**VARCHAR(100)**	**Yes**	**100**	**NOT NULL**	Credit Card Owner first, last and middle initial if included in name
3.	**CreditCardProcessingMerchantServiceCompanyCode (FK)**	**Number**	**TINYINT**	**Yes**	**20**	**CHECK(CreditCardProcessingMerchantServiceCompanyCode between 1 and 20) NOT NULL**	Column stores the Credit Card Processing Merchant Service Company unique code. **Foreign Key** to *CreditCardProcessingMerchantServiceCompany* Table.
4.	**CreditCardNetworkCompanyCode (FK)**	**Number**	**TINYINT**	**Yes**	**25**	**CHECK (CreditCardNetworkCompanyCode between 1 and 25)** **NOT NULL**	Stores the Credit Card Network Company unique code. **Foreign Key** to *CreditCardNetworkCompany* Table.
5.	**CreditCardIssuingBankCode (FK)**	**Number**	**TINYINT**	**Yes**	**25**	**CHECK (CreditCardIssuingBankCode between 1 and 25)** **NOT NULL**	Stores the Credit Card Issuing Bank unique code. **Foreign Key** to *CreditCardIssuingBank* Table.

6.	**CreditCardCorporate MerchantBankCode (FK)**	**Number**	**TINYINT**	**Yes**	**10**	**CHECK (CreditCardCorporateMerchantCode between 1 and 10)** **NOT NULL**	Stores the Credit Card Corporate Merchant Bank unique code. **Foreign Key** to *CreditCardCorporateMerchantBank* Table.
7.	**ExpDate**	**Date**	**DATE**	**Yes**	**MM-DD-YYYY**	**NOT NULL**	The date the credit card expires.
8.	**AddressLine1**	**String**	**VARCHAR(50)**	**Yes**	**50**	**NOT NULL**	Stores house/building number & street (part 1 of address).
9.	**AddressLine2 (O)**	**String**	**VARCHAR(50)**	**No**	**50**	**NULL**	Optional value that stores remaining part of address such as apartment number, or other address information.
10.	**City**	**String**	**VARCHAR(50)**	**Yes**	**50**	**NOT NULL**	Stores the city name
11.	**StateCode**	**Characters**	**CHAR(2)**	**Yes**	**2**	**NOT NULL**	Stores the U.S. State 2-character code. E.g., NY, NJ, CT, etc.
12.	**Zipcode**	**String**	**VARCHAR(10)**	**Yes**	**10**	**NOT NULL**	Stores US Zip Code/Postal Code. Support format: xxxxx-xxxx.
13.	**Country**	**String**	**VARCHAR(100)**	**Yes**	**100**	**NOT NULL**	Stores the name of the country.
14.	**CreditCardLimit**	**Number**	**DECIMAL(8,2)**	**Yes**	**X = 8** **Y = 2**	**NOT NULL**	The maximum amount of dollars that can be charged to the credit card. Assumes that the credit card has the full limit available. The format is **DECIMAL(X,Y),** where X = The total number of digits and Y = total number of digits to the right of the decimal point. We assume the maximum number that can be stored is 999999.99 for a maximum limit amount $999,999.99, since we don't expect a customer to have a credit limit of $1 Million dollars, we cap it at $999,999.99.
15.	**CreditCardAvailableCredit**	**Number**	**DECIMAL(8,2)**	**Yes**	**X=8** **Y=2**	**NOT NULL**	Stores the current remaining credit available for charging.
16.	**ActivationStatus**	**Boolean**	**BIT**	**Yes**	**1**	**NOT NULL**	Stores a Boolean value indicating True if credit card is active or False otherwise. The **MS SQL SERVER DBMS** has a Data Type named **BIT** that will store 1 to represent True and 0 to represent False.

CreditCardProcessingMerchantServiceCompany Dictionary Table using **MS SQL Server DBMS Data Types**:

CREDITCARDPROCESSINGMERCHANTSERVICECOMPANY							
Column Num.	Attribute/Column Name	Generic Data Type Name	MS SQL SERVER Data Type Name	Is it Required?	Length/Size /Format	Constraints	Description/ purpose
1.	**CreditCardProcessingMerchantServiceCompanyCode**	**Number**	**TINYINT**	**Yes**	**20**	**PRIMARY KEY CHECK(CreditCard Processing MerchantService CompanyCode between 1 and 20)**	***Unique Identifier*** or **Primary Key** for this table.
2.	**CreditCardProcessingMerchantServiceCompanyName (U)**	**String**	**VARCHAR(30)**	Yes	30	**CHECK(CreditCard Processing MerchantService CompanyName between 1 and 30)**	Stores the ***unique*** name of the Credit Card Processing Merchant Service Company.

CreditCardNetworkCompany Dictionary Table using **MS SQL Server DBMS Data Types**:

CREDITCARDNETWORKCOMPANY							
Column Num.	Attribute/Column Name	Generic Data Type Name	MS SQL SERVER Data Type Name	Is it Required?	Length/Size /Format		Description/ purpose
1.	**CreditCardNetworkCompanyCode**	**Number**	**TINYINT**	**Yes**	**20**	**PRIMARY KEY CHECK(CreditCard Network CompanyCode between 1 and 20)**	***Unique Identifier*** or **Primary Key** for this table.
2.	**CreditCardNetworkCompanyName (U)**	**String**	**VARCHAR(30)**	**Yes**	**30**	**UNIQUE NOT NULL CHECK(CreditCard Network CompanyName between 1 and 30)**	Stores the ***unique*** name of the Credit Card Network Company.

CreditCardIssuingBank Dictionary Table using **MS SQL Server DBMS Data Types**:

CREDITCARDISSUINGBANK							
Column Num.	Attribute/Column Name	Generic Data Type Name	MS SQL SERVER Data Type Name	Is it Required?	Length/Size /Format	Constraints	Description/ purpose
1.	**CreditCardIssuingBankCode**	**Number**	**TINYINT**	**Yes**	**25**	**Primary Key CHECK(CreditCardIssuingBankCode Between 1 and 25)**	***Unique Identifier*** or **Primary Key** for this table.
2.	**CreditCardIssuingBankName (U)**	**String**	**VARCHAR(20)**	**Yes**	**20**	**UNIQUE NOT NULL**	Stores the ***unique*** name of the Credit Card Processing Merchant Service Company.

CreditCardCorporateMerchantBank Dictionary Table using **MS SQL Server DBMS Data Types**:

CREDITCARDCORPORATEMERCHANTBANK							
Column Num.	Attribute/Column Name	Generic Data Type Name	MS SQL SERVER Data Type Name	Is it Required?	Length/Size /Format	Constraints	Description/ purpose
1.	**CreditCardCorporateMerchantBankCode**	**Number**	**TINYINT**	**Yes**	**10**	**Primary Key CHECK(CreditCardCorporateMerchant BankCode Between 1 and 10)**	***Unique Identifier*** or **Primary Key** for this table.
2.	**CreditCardCorporateMerchantBankName (U)**	**String**	**VARCHAR(30)**	**Yes**	**30**	**Not null Unique**	Stores the ***unique*** name of the Credit Card Corporate Merchant Bank.

UsState Dictionary Table using **MS SQL Server DBMS Data Types**:

USSTATE							
Column Num.	Attribute/Column Name	Generic Data Type Name	MS SQL SERVER Data Type Name	Is it Required?	Length/Size /Format	Constraints	Description/ purpose
1.	**StateID**	**Number**	**TINYINT**	**Yes**	75	Primary Key CHECK (StateId between 1 and 75)	***Unique Identifier*** or **Primary Key** for this table. This **Primary Key HAS Business Meaning**.
2.	**StateCode2Char (U)**	**Characters**	**CHAR(2)**	**Yes**	2	Not Null Unique	Stores the U.S. State 2-character code. E.g., NY, NJ, CT etc.
3.	**StateName (U)**	**String**	**VARCHAR(50)**	**Yes**	50	Not Null Unique	Stores the unique full name of the U.S. State.

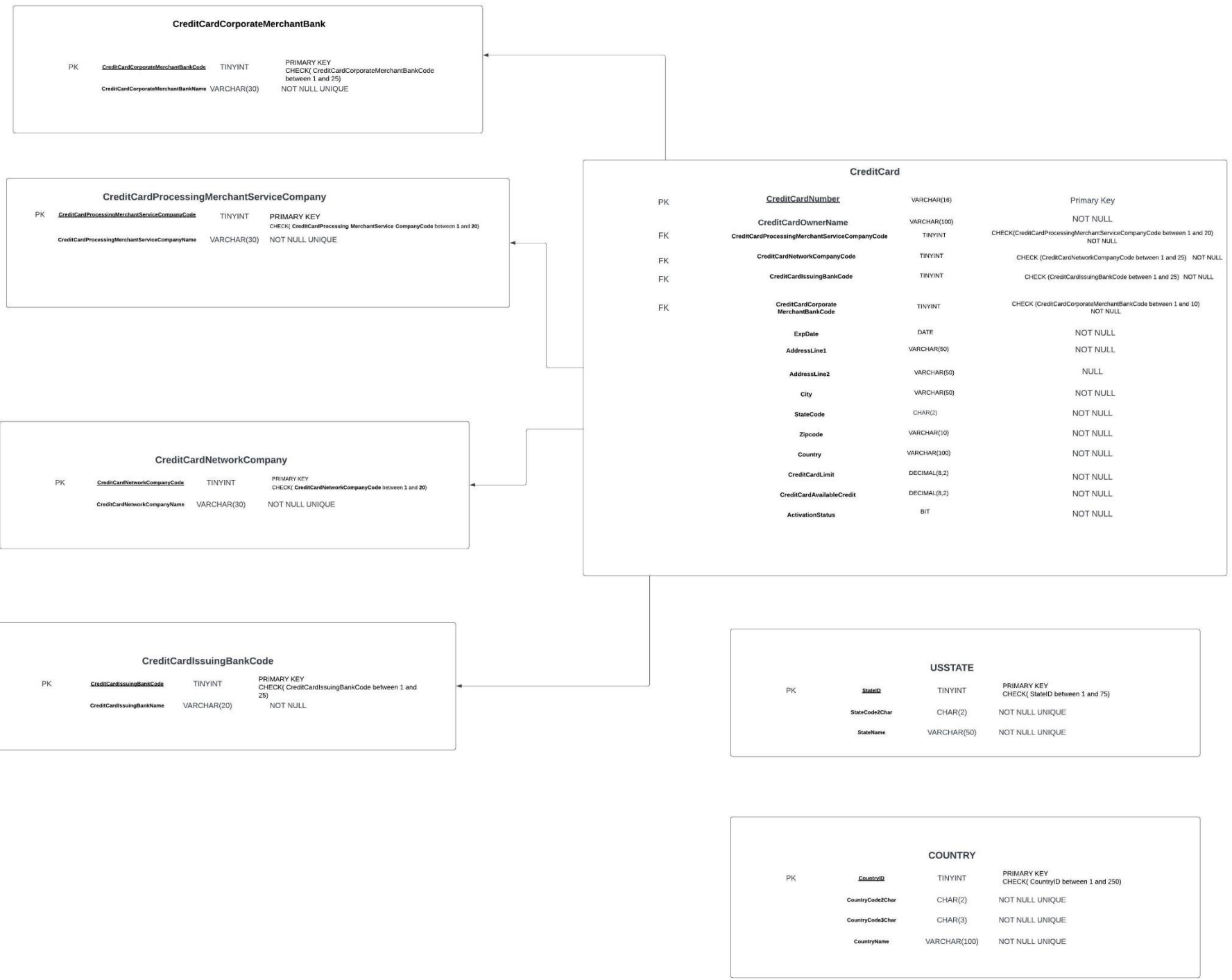
Country Dictionary Table using **MS SQL Server DBMS** **Data Types**:

COUNTRY							
Column Num.	Attribute/Column Name	Generic Data Type Name	**MS SQL SERVER** Data Type Name	Is it Required?	Length/Size /Format	Constraints	Description/ purpose
1.	**CountryID**	**Number**	**TINYINT**	**Yes**	**250**	Primary Key CHECK (CountryID between 1 and 250)	***Unique Identifier*** or **Primary Key** for this table.
2.	**CountryCode2Char (U)**	**Characters**	**CHAR(2)**	**Yes**	**2**	Not Null Unique	Stores the country 2-character code. E.g., US, GB, etc.
3.	**CountryCode3Char (U)**	**Characters**	**CHAR(3)**	**Yes**	**3**	Not Null Unique	Stores the country 3-character code. E.g., USA, GBR, etc.
4.	**CountryName (U)**	**String**	**VARCHAR(100)**	**Yes**	**100**	Not Null Unique	Stores the unique full name of the country.

Database Design Deliverable #5 – Physical Model Schema Design Diagram

This sub-section is the DESIGN of what the PHYSICAL Database or DBMS tables and their relationships will look like. This diagram was created by combining the Normalized Logical Model Diagram with the Physical Model Data Dictionary to make the below diagram, which is called the Physical Model Schema Design Diagram.

This diagram is used to implement the database in the DBMS Application; it also summarizes the tables and relationships required to implement the database in the DBMS application.


CreditCardCorporateMerchantBank
PK CreditCardCorporateMerchantBankCode TINYINT PRIMARY KEY CHECK(CreditCardCorporateMerchantBankCode between 1 and 25)
CreditCardCorporateMerchantBankName VARCHAR(30) NOT NULL UNIQUE
CreditCardProcessingMerchantServiceCompany
PK CreditCardProcessingMerchantServiceCompanyCode TINYINT PRIMARY KEY CHECK(CreditCardProcessing MerchantService CompanyCode between 1 and 20)
CreditCardProcessingMerchantServiceCompanyName VARCHAR(30) NOT NULL UNIQUE
CreditCard
PK CreditCardNumber VARCHAR(16) Primary Key
CreditCardOwnerName VARCHAR(100) NOT NULL
FK CreditCardProcessingMerchantServiceCompanyCode TINYINT CHECK(CreditCardProcessingMerchantServiceCompanyCode between 1 and 20) NOT NULL
FK CreditCardNetworkCompanyCode TINYINT CHECK (CreditCardNetworkCompanyCode between 1 and 25) NOT NULL
FK CreditCardIssuingBankCode TINYINT CHECK (CreditCardIssuingBankCode between 1 and 25) NOT NULL
FK CreditCardCorporate MerchantBankCode TINYINT CHECK (CreditCardCorporateMerchantBankCode between 1 and 10) NOT NULL
ExpDate DATE NOT NULL
AddressLine1 VARCHAR(50) NOT NULL
AddressLine2 VARCHAR(50) NULL
City VARCHAR(50) NOT NULL
StateCode CHAR(2) NOT NULL
Zipcode VARCHAR(10) NOT NULL
Country VARCHAR(100) NOT NULL
CreditCardLimit DECIMAL(8,2) NOT NULL
CreditCardAvailableCredit DECIMAL(8,2) NOT NULL
ActivationStatus BIT NOT NULL
CreditCardNetworkCompany
PK CreditCardNetworkCompanyCode TINYINT PRIMARY KEY CHECK(CreditCardNetworkCompanyCode between 1 and 20)
CreditCardNetworkCompanyName VARCHAR(30) NOT NULL UNIQUE
CreditCardIssuingBankCode
PK CreditCardIssuingBankCode TINYINT PRIMARY KEY CHECK(CreditCardIssuingBankCode between 1 and 25)
CreditCardIssuingBankName VARCHAR(20) NOT NULL
USSTATE
PK StateID TINYINT PRIMARY KEY CHECK(StateID between 1 and 75)
StateCode2Char CHAR(2) NOT NULL UNIQUE
StateName VARCHAR(50) NOT NULL UNIQUE
COUNTRY
PK CountryID TINYINT PRIMARY KEY CHECK(CountryID between 1 and 250)
CountryCode2Char CHAR(2) NOT NULL UNIQUE
CountryCode3Char CHAR(3) NOT NULL UNIQUE
CountryName VARCHAR(100) NOT NULL UNIQUE

Database Implementation Deliverable #6 – Development & Implementation

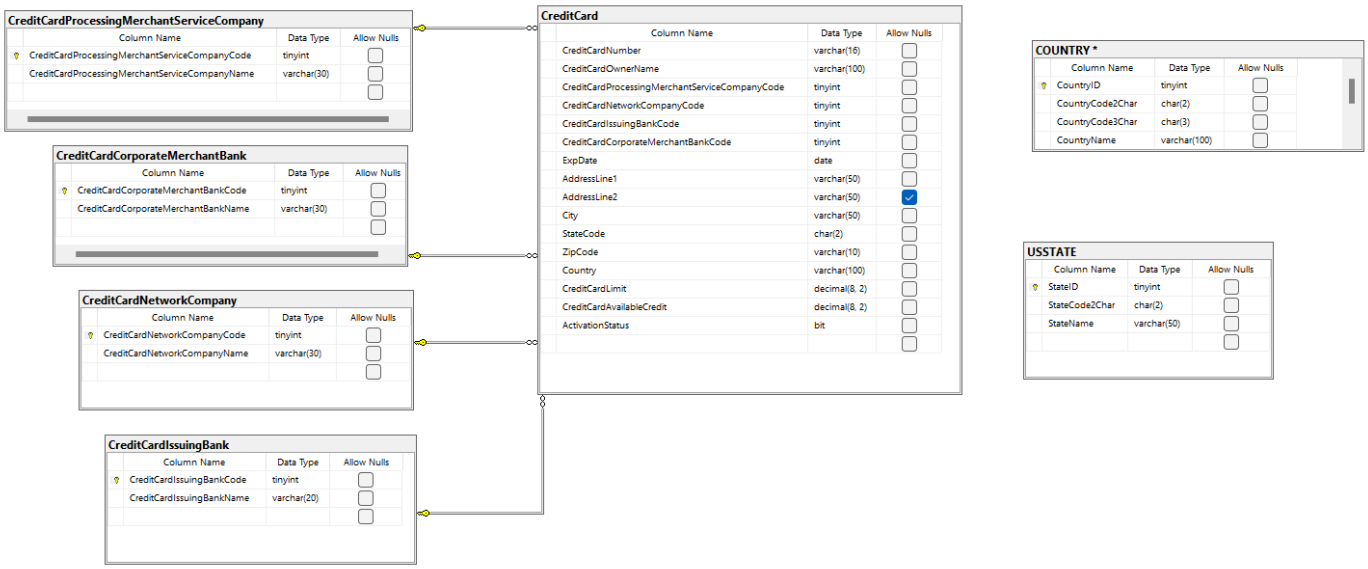
This sub-section shows the script that was used to create the various tables in the EZRental Database. The Physical Schema Diagram from Deliverable #5 was used to make these Data Definition Language Create Table Statements.

```
-- Creating the database

CREATE DATABASE EZRentalDB

--Create Credit Card Corporate Merchant Bank Table
CREATE TABLE CreditCardCorporateMerchantBank
(
	CreditCardCorporateMerchantBankCode  TINYINT     PRIMARY KEY
CHECK(CreditCardCorporateMerchantBankCode between 1 and 20),
	CreditCardCorporateMerchantBankName   VARCHAR(30) UNIQUE NOT NULL
);

--CreateCreditCard Processing Merchant Service Company Table
CREATE TABLE CreditCardProcessingMerchantServiceCompany
(
	CreditCardProcessingMerchantServiceCompanyCode  TINYINT     PRIMARY KEY
CHECK(CreditCardProcessingMerchantServiceCompanyCode between 1 and 20),
	CreditCardProcessingMerchantServiceCompanyName   VARCHAR(30) UNIQUE NOT NULL
);
--Create CreditCard Network Company  Table
CREATE TABLE CreditCardNetworkCompany
(
	CreditCardNetworkCompanyCode  TINYINT     PRIMARY KEY CHECK(CreditCardNetworkCompanyCode between
1 and 20),
	CreditCardNetworkCompanyName   VARCHAR(30) UNIQUE NOT NULL
);
--Create CreditCard Issuing Bank Code Table
CREATE TABLE CreditCardIssuingBank
(
	CreditCardIssuingBankCode  TINYINT     PRIMARY KEY CHECK(CreditCardIssuingBankCode between 1 and
25) ,
	CreditCardIssuingBankName   VARCHAR(20)  NOT NULL
);
```

```sql
--Create Credit Card Table
CREATE TABLE CreditCard
(
	CreditCardNumber  VARCHAR(16)     NOT NULL,
	CreditCardOwnerName VARCHAR(100) NOT NULL,
	CreditCardProcessingMerchantServiceCompanyCode TINYINT
CHECK(CreditCardProcessingMerchantServiceCompanyCode between 1 and 20) NOT NULL,
	CreditCardNetworkCompanyCode TINYINT NOT NULL CHECK(CreditCardNetworkCompanyCode between 1 and
20),
	CreditCardIssuingBankCode TINYINT NOT NULL CHECK(CreditCardIssuingBankCode between 1 and 25),
	CreditCardCorporateMerchantBankCode TINYINT NOT NULL CHECK(CreditCardCorporateMerchantBankCode
between 1 and 20),
	ExpDate DATE NOT NULL,
	AddressLine1 VARCHAR(50) NOT NULL,
	AddressLine2  VARCHAR(50) NULL,
	City VARCHAR(50) NOT NULL,
	StateCode CHAR(2) NOT NULL,
	ZipCode VARCHAR(10) NOT NULL,
	Country VARCHAR(100) NOT NULL,
	CreditCardLimit DECIMAL(8,2) NOT NULL,
	CreditCardAvailableCredit DECIMAL(8,2) NOT NULL,
	ActivationStatus BIT NOT NULL,

	CONSTRAINT fk_CreditCardProcessingMerchantServiceCompanyCode
	FOREIGN KEY (CreditCardProcessingMerchantServiceCompanyCode)
	REFERENCES
CreditCardProcessingMerchantServiceCompany(CreditCardProcessingMerchantServiceCompanyCode)
	ON DELETE CASCADE ON UPDATE CASCADE ,

	CONSTRAINT fk_CreditCardCorporateMerchantBankCode
	FOREIGN KEY (CreditCardCorporateMerchantBankCode)
	REFERENCES CreditCardCorporateMerchantBank(CreditCardCorporateMerchantBankCode)
	ON DELETE CASCADE ON UPDATE CASCADE ,

	CONSTRAINT fk_CreditCardNetworkCompanyCode
	FOREIGN KEY (CreditCardNetworkCompanyCode)
	REFERENCES CreditCardNetworkCompany(CreditCardNetworkCompanyCode)
	ON DELETE CASCADE ON UPDATE CASCADE,

	CONSTRAINT fk_CreditCardIssuingBank
	FOREIGN KEY (CreditCardIssuingBankCode)
	REFERENCES CreditCardIssuingBank(CreditCardIssuingBankCode)
	ON DELETE CASCADE ON UPDATE CASCADE
);

--Create State Table
CREATE TABLE USSTATE
(
	StateID  TINYINT     PRIMARY KEY,CHECK (StateID between 1 and 75)
	StateCode2Char   CHAR(2)  NOT NULL UNIQUE,
	StateName VARCHAR(50) NOT NULL UNIQUE
);

--Create COUNTRY Table
CREATE TABLE COUNTRY
(
	CountryID  TINYINT     PRIMARY KEY, CHECK (CountryID between 1 and 250)
	CountryCode2Char   CHAR(2)  NOT NULL UNIQUE,
	CountryCode3Char CHAR(3) NOT NULL UNIQUE,
	CountryName VARCHAR(100) NOT NULL UNIQUE
);
```

Database Implementation Deliverable #7 – Implemented Physical Schema Diagram

This sub-section displays the schema diagram generated from implementing the Create table statements, as mentioned in deliverable #6. This replicates the diagram from deliverable #5, which was used to implement the database.



Database Implementation Deliverable #8 – Database Validation Testing

This sub-section describes the methods successfully used to test the Database Application with the features and functionalities of the Front-end Rental Offices Two-Tier Client/Server Physical Architecture. Various tests were performed to ensure the database would be acceptable for live operations, including Populating, Searching, Updating, and Deleting tables. These tests were created while considering the business requirements provided by EzRental Inc.

Populating The CreditCardProcessingMerchantServiceCompany Table

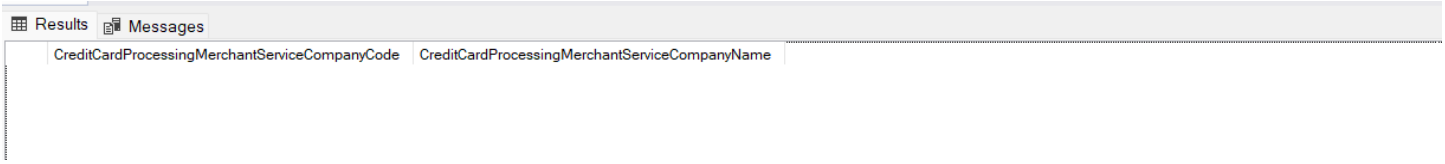
This section shows the content of the **CreditCardProcessingMerchantServiceCompany Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardProcessingMerchantServiceCompany Table**:

```
SELECT *
FROM CreditCardProcessingMerchantServiceCompany;
```

The current state of the CreditCardProcessingMerchantServiceCompany Table is:



List of SQL INSERT STATEMENTS used to Populate the table:

```
INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('1' ,'Stax By Fattmerchant');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('2' ,'Helcim');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('3' ,'Dharma Merchant Service');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('4' ,'Payment Depot');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('5' ,'National Processing');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('6' ,'Block');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('7' ,'Intuit Quickbooks');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('8' ,'Paypal');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('9' ,'Stripe');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('10' ,'Flagship Merchant Service');


INSERT INTO CreditCardProcessingMerchantServiceCompany (CreditCardProcessingMerchantServiceCompanyCode,
CreditCardProcessingMerchantServiceCompanyName) VALUES('11' ,'Clover');
```

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardProcessingMerchantServiceCompany Table**:

```
SELECT *
FROM CreditCardProcessingMerchantServiceCompany;
```

The final state of the **CreditCardProcessingMerchantServiceCompany is**

Results Messages

	CreditCardProcessingMerchantServiceCompanyCode	CreditCardProcessingMerchantServiceCompanyName
1	1	Stax By Fattmerchant
2	2	Helcim
3	3	Dharma Merchant Service
4	4	Payment Depot
5	5	National Processing
6	6	Block
7	7	Intuit Quickbooks
8	8	Paypal
9	9	Stripe
10	10	Flagship Merchant Service
11	11	Clover

Populating The CreditCardNetworkCompany Table

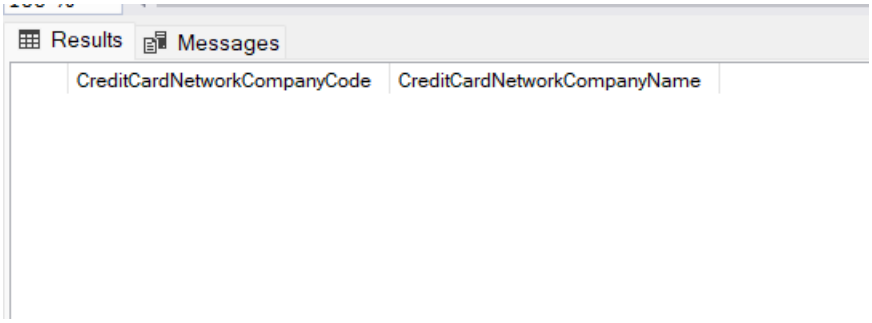
This section shows the content of the **CreditCardNetworkCompany Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardNetworkCompany Table**:

```
SELECT *
FROM CreditCardNetworkCompany;
```

The current state of the **CreditCardNetworkCompany Table** is:



List of SQL INSERT STATEMENTS used to Populate the table:

The following SQL INSERT STATEMENTS were used

```
INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('1' ,'American Express');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('2' ,'Visa');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('3' ,'Mastercard');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('4' ,'Discover');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('5' ,'Diners Club');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('6' ,'Interlink');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('7' ,'Star');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('8' ,'Acel');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('9' ,'Interac');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('10' ,'Visa ReadyLink');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('11' ,'Pulse');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('12' ,'JCB (Japan Credit Bureau)');

INSERT INTO CreditCardNetworkCompany(CreditCardNetworkCompanyCode, CreditCardNetworkCompanyName)
VALUES('13' ,'Rupay');
```

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardNetworkCompany Table**:

```
SELECT *
FROM CreditCardNetworkCompany;
```

The final state of the **CreditCardNetworkCompany is :**

Results Messages

	CreditCardNetworkCompanyCode	CreditCardNetworkCompanyName
1	1	American Express
2	2	Visa
3	3	Mastercard
4	4	Discover
5	5	Diners Club
6	6	Interlink
7	7	Star
8	8	Acel
9	9	Interac
10	10	Visa ReadyLink
11	11	Pulse
12	12	JCB (Japan Credit Bureau)
13	13	Rupay

Populating The CreditCardIssuingBank Table

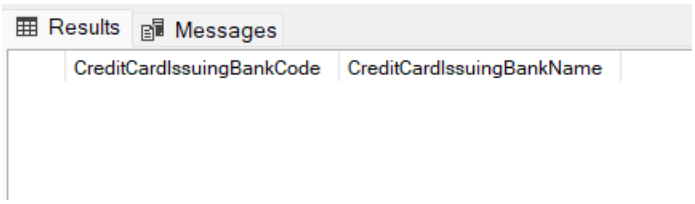
This section shows the content of the **CreditCardIssuingBank Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardIssuingBank Table**:

```
SELECT *
FROM CreditCardIssuingBank;
```

The current state of the **CreditCardIssuingBank Table** is:



List of SQL INSERT STATEMENTS used to Populate the table:

```
INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('1' ,'American Express');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('2' ,'Bank of America');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('3' ,'Barclays');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('4' ,'Capital One');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('5' ,'Chase');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('6' ,'Citi');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('7' ,'Discover');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('8' ,'Synchrony Bank');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('9' ,'U.S. Bank');

INSERT INTO CreditCardIssuingBank(CreditCardIssuingBankCode, CreditCardIssuingBankName)
VALUES('10' ,'Wells Fargo');
```

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardIssuingBank Table**:

```
SELECT *
FROM CreditCardIssuingBank;
```

The final state of the **CreditCardIssuingBank table is :**

	CreditCardIssuingBankCode	CreditCardIssuingBankName
1	1	American Express
2	2	Bank of America
3	3	Barclays
4	4	Capital One
5	5	Chase
6	6	Citi
7	7	Discover
8	8	Synchrony Bank
9	9	U.S. Bank
10	10	Wells Fargo

Populating The CreditCardCorporateMerchantBank Table

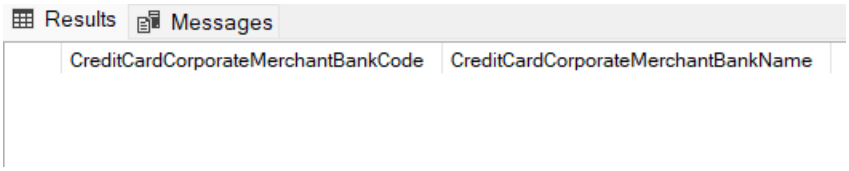
This section shows the content of the **CreditCardCorporateMerchantBank Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardCorporateMerchantBankTable**:

```
SELECT *
FROM CreditCardCorporateMerchantBank;
```

The current state of the **CreditCardCorporateMerchantBank Table** is:



List of SQL INSERT STATEMENTS used to Populate the table:

```
INSERT INTO
CreditCardCorporateMerchantBank(CreditCardCorporateMerchantBankCode,CreditCardCorporateMerchantBankName
)
VALUES('1' ,'Chase');

INSERT INTO
CreditCardCorporateMerchantBank(CreditCardCorporateMerchantBankCode,CreditCardCorporateMerchantBankName
)
VALUES('2' ,'Citi');

INSERT INTO
CreditCardCorporateMerchantBank(CreditCardCorporateMerchantBankCode,CreditCardCorporateMerchantBankName
)
VALUES('3' ,'Capital One');
```

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCardCorporateMerchantBank Table**:

```
SELECT *

FROM CreditCardCorporateMerchantBank;
```

The final state of the **CreditCardCorporateMerchantBank** table is

	CreditCardCorporateMerchantBankCode	CreditCardCorporateMerchantBankName
1	3	Capital One
2	1	Chase
3	2	Citi

Populating The CreditCard Table

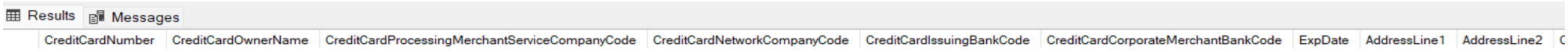
This section shows the content of the **CreditCard Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:



List of SQL INSERT STATEMENTS used to Populate the table:

```
INSERT INTO CreditCard (CreditCardNumber,CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode,CreditCardIssuingBankCode,
CreditCardCorporateMerchantBankCode,ExpDate,AddressLine1,
AddressLine2,City,StateCode,ZipCode,Country,CreditCardLimit,CreditCardAvailableCredit,ActivationStatus)
VALUES('1111111111111111','John Brown','5','2','8','2','01/25/2027', '35 Stevens Street', 'Apt 2',
'Mt Vernon' , 'NY', '10550' , 'USA','10000.00','10000.00','0');

INSERT INTO CreditCard(CreditCardNumber, CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode, CreditCardIssuingBankCode, CreditCardCorporateMerchantBankCode, ExpDate,
AddressLine1,
AddressLine2, City, StateCode, ZipCode, Country, CreditCardLimit, CreditCardAvailableCredit,
ActivationStatus)
VALUES ('2222222222222222', 'Snake Plissken', '2', '1', '5', '1', '02/25/2027', '42 Liberty Island',
'Apt 205', 'Pelham','NY', '18604', 'USA', 10000.00, 10000.00, '0');

INSERT INTO CreditCard(CreditCardNumber, CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode, CreditCardIssuingBankCode, CreditCardCorporateMerchantBankCode, ExpDate,
AddressLine1,
AddressLine2, City, StateCode, ZipCode, Country, CreditCardLimit, CreditCardAvailableCredit,
ActivationStatus)
VALUES ('3333333333333333', 'Ellen Ripley', '5', '3', '1', '2', '03/31/2028', '426 Hudson Street',
NULL, 'Eastchester','NY', '10014', 'USA', 10000.00, 10000.00, '0');

INSERT INTO CreditCard (CreditCardNumber, CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode, CreditCardIssuingBankCode, CreditCardCorporateMerchantBankCode, ExpDate,
AddressLine1,
AddressLine2, City, StateCode, ZipCode, Country, CreditCardLimit, CreditCardAvailableCredit,
ActivationStatus)
VALUES ('4444444444444444', 'Indiana Jones', '2', '5', '6', '3', '03/31/2028', '1600 Broadway', 'Apt
65', 'Larchmont','NY', '10019', 'USA', 10000.00, 10000.00, '1');

INSERT INTO CreditCard (CreditCardNumber, CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode, CreditCardIssuingBankCode, CreditCardCorporateMerchantBankCode, ExpDate,
AddressLine1,
AddressLine2, City, StateCode, ZipCode, Country, CreditCardLimit, CreditCardAvailableCredit,
ActivationStatus)
VALUES ('5555555555555555', 'Mack Turner', '1', '2', '7', '1', '03/31/2028', '777 Seventh Avenue',
'Apt65', 'Elmsford','NY', '10019', 'USA', 10000.00, 10000.00, '0');

INSERT INTO CreditCard (CreditCardNumber, CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode, CreditCardIssuingBankCode, CreditCardCorporateMerchantBankCode, ExpDate,
AddressLine1,
AddressLine2, City, StateCode, ZipCode, Country, CreditCardLimit, CreditCardAvailableCredit,
ActivationStatus)
VALUES ('6666666666666666', 'Han Solo', '4', '1', '5', '2', '03/31/2028', '1138 Millennium Falcon Way',
'BLD35', 'Sleep Hollow', 'NY', '10001', 'USA', 10000.00, 10000.00, '0');

INSERT INTO CreditCard(CreditCardNumber, CreditCardOwnerName,
CreditCardProcessingMerchantServiceCompanyCode,
CreditCardNetworkCompanyCode, CreditCardIssuingBankCode, CreditCardCorporateMerchantBankCode, ExpDate,
AddressLine1,
AddressLine2, City, StateCode, ZipCode, Country, CreditCardLimit, CreditCardAvailableCredit,
ActivationStatus)
VALUES ('7777777777777777', 'Tom Cody', '4', '1', '5', '3', '03/31/2028', '1984 Streets Avenue', NULL,
'Yonkers','NY', '10002', 'USA', 10000.00, 10000.00, '0');
```

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The final state of the **CreditCard table is**

Results Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	A
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	/
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	/
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	I
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	/
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	/
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	I
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	I

Populating The Country Table

This section shows the content of the **Country Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **Country Table**:

```
SELECT *
FROM Country;
```

The current state of the **Country Table** is:

IMPORTING data from CSV File

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **Country Table**:

```
SELECT *
FROM Country;
```

Results Messages

	CountryID	CountryCode2Char	CountryCode3Char	CountryName
1	1	AX	ALA	AALAND ISLANDS
2	2	AF	AFG	AFGHANISTAN
3	3	AL	ALB	ALBANIA
4	4	DZ	DZA	ALGERIA
5	5	AS	ASM	AMERICAN SAMOA
6	6	AD	AND	ANDORRA
7	7	AO	AGO	ANGOLA
8	8	AI	AIA	ANGUILLA
9	9	AQ	ATA	ANTARCTICA
10	10	AG	ATG	ANTIGUA AND BARBUDA
11	11	AR	ARG	ARGENTINA
12	12	AM	ARM	ARMENIA
13	13	AW	ABW	ARUBA
14	14	AU	AUS	AUSTRALIA
15	15	AT	AUT	AUSTRIA
16	16	AZ	AZE	AZERBAIJAN
17	17	BS	BHS	BAHAMAS

Populating The USSTATE Table

This section shows the content of the **USSTATE Table** before and after populating it with records using an **SQL INSERT STATEMENTS**.

Table Before Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **USSTATE Table**:

```
SELECT *
FROM USSTATE;
```

The current state of the **USSTATE Table** is:

IMPORTING data from CSV File

Table After Execution of SQL INSERT STATEMENTS:

The following **SQL SELECT Statement** was used to list the content of the **USSTATE Table**:

```
SELECT *
FROM USSTATE;
```

The final state of the **USSTATE table is :**

Results Messages

	StateID	StateCode2Char	StateName
1	1	AL	ALABAMA
2	2	AK	ALASKA
3	3	AS	AMERICAN SAMOA
4	4	AZ	ARIZONA
5	5	AR	ARKANSAS
6	6	CA	CALIFORNIA
7	7	CO	COLORADO
8	8	CT	CONNECTICUT
9	9	DE	DELAWARE
10	10	DC	DISTRICT OF COLUMBIA
11	11	FL	FLORIDA
12	12	GA	GEORGIA
13	13	GU	GUAM
14	14	HI	HAWAII
15	15	ID	IDAHO
16	16	IL	ILLINOIS
17	17	IN	INDIANA

Searching The CreditCard Table via SQL SELECT Statement

This section shows the test & validates the result of querying the **CreditCard Table** using an **SQL SELECT STATEMENT**.

Table Before Execution of SQL SELECT STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

Results | Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	A
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	/
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	/
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	I
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	/
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	/
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	I
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	I

Listing of SQL SELECT STATEMENT used to query the table:

The following **SQL SELECT Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
SELECT *
FROM CreditCard
WHERE CreditCardNumber ='7777777777777777';
```

Table After Execution of SQL SELECT STATEMENT:

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	AddressLine2	C
1	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL	1

Searching The CreditCard Table via SQL SELECT Statement

This section shows the test & validates the result of querying the **CreditCard Table** using an **SQL SELECT STATEMENT**.

Table Before Execution of SQL SELECT STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

Results | Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	Address
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL

Listing of SQL SELECT STATEMENT used to query the table:

The following **SQL SELECT Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
SELECT CreditCardNumber ,CreditCardOwnerName , ExpDate , AddressLine1 , AddressLine2 , City , StateCode
, ZipCode , ActivationStatus
FROM CreditCard
WHERE City ='Pelham';
```

Table After Execution of SQL SELECT STATEMENT:
Results of the execution of the SELECT Statement

The final state of the **CreditCard table is**

Messages

	CreditCardNumber	CreditCardOwnerName	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	ActivationStatus
1	2222222222222222	Snake Plissken	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604	0
2	8888888888888888	Jim Brown	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002	0

Searching The CreditCard Table via SQL SELECT Statement

This section shows the test & validates the result of querying the **CreditCard Table** using an **SQL SELECT STATEMENT**.

Table Before Execution of SQL SELECT STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

Results Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	Address
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL

Listing of SQL SELECT STATEMENT used to query the table:

The following **SQL SELECT Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
SELECT CreditCard.CreditCardNumber, CreditCard.CreditCardOwnerName,
CreditCard.ExpDate,CreditCard.AddressLine1,
CreditCard.AddressLine2,CreditCard.City , CreditCard.StateCode , CreditCard.ZipCode,
CreditCard.Country,
CreditCard.CreditCardLimit,CreditCard.CreditCardAvailableCredit,CreditCard.ActivationStatus,
CreditCardProcessingMerchantServiceCompany.CreditCardProcessingMerchantServiceCompanyName,
CreditCardNetworkCompany.CreditCardNetworkCompanyName,CreditCardIssuingBank.CreditCardIssuingBankName,
CreditCardCorporateMerchantBank.CreditCardCorporateMerchantBankName
FROM CreditCard
INNER JOIN CreditCardProcessingMerchantServiceCompany ON
CreditCard.CreditCardProcessingMerchantServiceCompanyCode =
CreditCardProcessingMerchantServiceCompany.CreditCardProcessingMerchantServiceCompanyCode
INNER JOIN  CreditCardNetworkCompany ON CreditCard.CreditCardNetworkCompanyCode =
CreditCardNetworkCompany.CreditCardNetworkCompanyCode
INNER JOIN  CreditCardIssuingBank ON CreditCard.CreditCardIssuingBankCode =
CreditCardIssuingBank.CreditCardIssuingBankCode
INNER JOIN  CreditCardCorporateMerchantBank ON CreditCard.CreditCardCorporateMerchantBankCode =
CreditCardCorporateMerchantBank.CreditCardCorporateMerchantBankCode
WHERE CreditCard.CreditCardNumber = '3333333333333333';
```

Table After Execution of SQL SELECT STATEMENT:

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	Country	CreditCardLimit	CreditCardAvailableCredit	ActivationStatus	CreditCardProcessingMerchantServiceCompanyName
1	3333333333333333	Ellen Ripley	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014	USA	10000.00	10000.00	0	National Processing

CreditCardNetworkCompanyName	CreditCardIssuingBankName	CreditCardCorporateMerchantBankName
Mastercard	American Express	Citi

Searching The CreditCard Table via SQL SELECT Statement

This section shows the test & validates the result of querying the **CreditCard Table** using an **SQL SELECT STATEMENT**.

Table Before Execution of SQL SELECT STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

Results | Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	Address
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL

Listing of SQL SELECT STATEMENT used to query the table:

The following **SQL SELECT Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
SELECT CreditCard.CreditCardNumber, CreditCard.CreditCardOwnerName,
CreditCard.ExpDate,CreditCard.AddressLine1,
CreditCard.AddressLine2,CreditCard.City , CreditCard.StateCode , CreditCard.ZipCode,
CreditCard.Country,
CreditCard.CreditCardLimit,CreditCard.CreditCardAvailableCredit,CreditCard.ActivationStatus,
CreditCardProcessingMerchantServiceCompany.CreditCardProcessingMerchantServiceCompanyName,
CreditCardNetworkCompany.CreditCardNetworkCompanyName,CreditCardIssuingBank.CreditCardIssuingBankName,
CreditCardCorporateMerchantBank.CreditCardCorporateMerchantBankName
FROM CreditCard
INNER JOIN CreditCardProcessingMerchantServiceCompany ON
CreditCard.CreditCardProcessingMerchantServiceCompanyCode =
CreditCardProcessingMerchantServiceCompany.CreditCardProcessingMerchantServiceCompanyCode
INNER JOIN  CreditCardNetworkCompany ON CreditCard.CreditCardNetworkCompanyCode =
CreditCardNetworkCompany.CreditCardNetworkCompanyCode
INNER JOIN  CreditCardIssuingBank ON CreditCard.CreditCardIssuingBankCode =
CreditCardIssuingBank.CreditCardIssuingBankCode
INNER JOIN  CreditCardCorporateMerchantBank ON CreditCard.CreditCardCorporateMerchantBankCode =
CreditCardCorporateMerchantBank.CreditCardCorporateMerchantBankCode
```

Table After Execution of **SQL SELECT STATEMENT**

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	Country	CreditCardLimit	CreditCardAvailableCredit	ActivationStatus	CreditCardProcessingMerchantServiceCompanyName	CreditCardNetworkCompanyName
1	1111111111111111	John Brown	2027-01-25	35 Stevens Street	Apt 2	Mt Vernon	NY	10550	USA	10000.00	10000.00	0	National Processing	Visa
2	2222222222222222	Snake Plissken	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604	USA	10000.00	10000.00	0	Helcim	American Express
3	3333333333333333	Ellen Ripley	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014	USA	10000.00	10000.00	0	National Processing	Mastercard
4	4444444444444444	Indiana Jones	2028-03-31	1600 Broadway	Apt 65	Larchmont	NY	10019	USA	10000.00	10000.00	1	Helcim	Diners Club
5	5555555555555555	Mack Turner	2028-03-31	777 Seventh Avenue	Apt65	Elmsford	NY	10019	USA	10000.00	10000.00	0	Stax By Fattmerchant	Visa
6	6666666666666666	Han Solo	2028-03-31	1138 Millennium Falcon Way	BLD35	Sleep Hollow	NY	10001	USA	10000.00	10000.00	0	Payment Depot	American Express
7	7777777777777777	Tom Cody	2028-03-31	1984 Streets Avenue	NULL	Yonkers	NY	10002	USA	10000.00	10000.00	0	Payment Depot	American Express
8	8888888888888888	Jim Brown	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002	USA	10000.00	10000.00	0	Stax By Fattmerchant	Mastercard

CreditCardIssuingBankName	CreditCardCorporateMerchantBankName
Synchrony Bank	Citi
Chase	Chase
American Express	Citi
Citi	Capital One
Discover	Chase
Chase	Citi
Chase	Capital One
Bank of America	Chase

Updating Record(s) in The CreditCard Table via SQL UPDATE Statement

This section shows the test & validates the result of querying the **CreditCard Table** before and after using an **SQL UPDATE STATEMENT**.

Table Before Execution of SQL UPDATE STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	Country	CreditC
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2	Mt Vernon	NY	10550	USA	10000
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604	USA	10000
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014	USA	10000
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65	Larchmont	NY	10019	USA	10000
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65	Elmsford	NY	10019	USA	10000
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35	Sleep Hollow	NY	10001	USA	10000
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL	Yonkers	NY	10002	USA	10000
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002	USA	10000
9	8888555599992222	Pablo Escobar	7	1	1	2	2025-01-05	30 Hollow Road	APT 75	Riverdale	NY	10453	USA	10000

Listing of **SQL UPDATE STATEMENT** used to query the table:

The following **SQL UPDATE Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
--New CreditCard Record  for the first update test

INSERT INTO CreditCard

VALUES ('8888555599992222', 'Pablo Escobar','7','1','1','2','01/05/2025','30 Hollow Road','APT 75' ,
'Riverdale', 'NY','10453','USA', 10000.00,10000.00,'1' );


--Update  all the fields of a CreditCard Record  except for the primary key

UPDATE CreditCard

SET CreditCardOwnerName = 'Tim Horton' ,CreditCardProcessingMerchantServiceCompanyCode = '4' ,
CreditCardNetworkCompanyCode = '2' , CreditCardIssuingBankCode = '3',
CreditCardCorporateMerchantBankCode ='1',
ExpDate= '01/05/2028' ,AddressLine1 = '25 Sleep Drive' , AddressLine2  = 'Apt 1' , City = 'Exton' ,
StateCode = 'PA', ZipCode = '10958', Country = 'UK'

WHERE CreditCardNumber = '8888555599992222';
```

Table After Execution of **SQL UPDATE STATEMENT**:

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	Country
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2	Mt Vernon	NY	10550	USA
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604	USA
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014	USA
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65	Larchmont	NY	10019	USA
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65	Elmsford	NY	10019	USA
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35	Sleep Hollow	NY	10001	USA
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL	Yonkers	NY	10002	USA
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002	USA
9	8888555599992222	Tim Horton	4	2	3	1	2028-01-05	25 Sleep Drive	Apt 1	Exton	PA	10958	UK

Updating Record(s) in The CreditCard Table via SQL UPDATE Statement

This section shows the test & validates the result of querying the **CreditCard Table** before and after using an **SQL UPDATE STATEMENT**.

Table Before Execution of SQL UPDATE STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	Country
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2	Mt Vernon	NY	10550	USA
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604	USA
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014	USA
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65	Larchmont	NY	10019	USA
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65	Elmsford	NY	10019	USA
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35	Sleep Hollow	NY	10001	USA
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL	Yonkers	NY	10002	USA
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002	USA
9	8888555599992222	Tim Horton	4	2	3	1	2028-01-05	25 Sleep Drive	Apt 1	Exton	PA	10958	UK
10	8888777722223333	John Escobar	8	3	1	2	2025-01-07	30 Deep Road	APT 5	Riverhead	NY	10453	USA

Listing of **SQL UPDATE STATEMENT** used to query the table:

The following **SQL UPDATE Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
--New CreditCard Record  for the second update test

 INSERT INTO CreditCard
VALUES ('8888777722223333', 'John Escobar','8','3','1','2','01/07/2025','30 Deep Road','APT 5' ,
'Riverhead', 'NY','10453','USA', 10000.00,10000.00,'1' );

--Update a CreditCard Record  but only specific  columns

UPDATE CREDITCARD

SET AddressLine1 = '25 Jump Drive' , AddressLine2  = 'Apt 1' , City = 'Exton' , StateCode = 'PA',
ZipCode = '10958', Country = 'UK'

WHERE CreditCardNumber = '8888777722223333';
```

Table After Execution of **SQL UPDATE STATEMENT**:

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode	Country
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2	Mt Vernon	NY	10550	USA
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604	USA
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014	USA
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65	Larchmont	NY	10019	USA
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65	Elmsford	NY	10019	USA
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35	Sleep Hollow	NY	10001	USA
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL	Yonkers	NY	10002	USA
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002	USA
9	8888555599992222	Tim Horton	4	2	3	1	2028-01-05	25 Sleep Drive	Apt 1	Exton	PA	10958	UK
10	8888777722223333	John Escobar	8	3	1	2	2025-01-07	25 Jump Drive	Apt 1	Exton	PA	10958	UK

Updating Record(s) in The CreditCard Table via SQL UPDATE Statement

This section shows the test & validates the result of querying the **CreditCard Table** before and after using an **SQL UPDATE STATEMENT**.

Table Before Execution of SQL UPDATE STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode
1	1111111111111111	John Brown	5	2	8	2
2	2222222222222222	Snake Plissken	2	1	5	1
3	3333333333333333	Ellen Ripley	5	3	1	2
4	4444444444444444	Indiana Jones	2	5	6	3
5	5555555555555555	Mack Turner	1	2	7	1
6	6666666666666666	Han Solo	4	1	5	2
7	7777777777777777	Tom Cody	4	1	5	3
8	8888888888888888	Jim Brown	1	3	2	1
9	8888555599992222	Tim Horton	4	2	3	1
10	8888777722223333	John Escobar	8	3	1	2
11	8888444499992222	Esteban Chulo	6	2	3	1

Listing of **SQL UPDATE STATEMENT** used to query the table:

The following **SQL UPDATE Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
--Insert into table a new CreditCard Processing  Merchant Service Company for the test  for changing a
Credit Card Record's Processing  Merchant Service Company to a new one that does not exist.

--Insert new CreditCardProcessingMerchantServiceCompany Into the table for the update query
INSERT INTO CreditCardProcessingMerchantServiceCompany

VALUES ( '12', 'Gravity Payments');


--New CreditCard Record  for the update test

INSERT INTO CreditCard

VALUES ('8888444499992222', 'Esteban Chulo','6','2','3','1','01/05/2025','12 Eastchester Road','APT 7'
, 'Bronx', 'NY','10623','USA' , 10000.00,10000.00,'1');


--Make update to the Credit Card Record

UPDATE CreditCard

SET CreditCardProcessingMerchantServiceCompanyCode = '12'

WHERE CreditCardNumber = '8888444499992222';
```

Table After Execution of **SQL UPDATE STATEMENT**:

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode
1	1111111111111111	John Brown	5	2	8	2
2	2222222222222222	Snake Plissken	2	1	5	1
3	3333333333333333	Ellen Ripley	5	3	1	2
4	4444444444444444	Indiana Jones	2	5	6	3
5	5555555555555555	Mack Turner	1	2	7	1
6	6666666666666666	Han Solo	4	1	5	2
7	7777777777777777	Tom Cody	4	1	5	3
8	8888888888888888	Jim Brown	1	3	2	1
9	8888555599992222	Tim Horton	4	2	3	1
10	8888777722223333	John Escobar	8	3	1	2
11	8888444499992222	Esteban Chulo	12	2	3	1

Deleting Record(s) in The CreditCard Table via SQL DELETE Statement

This section shows the test & validates the result of querying the **CreditCard Table** before and after using an **SQL DELETE STATEMENT**.

Table Before Execution of SQL DELETE STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1	AddressLine2	City	StateCode	ZipCode
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street	Apt 2	Mt Vernon	NY	10550
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island	Apt 205	Pelham	NY	18604
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street	NULL	Eastchester	NY	10014
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway	Apt 65	Larchmont	NY	10019
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue	Apt65	Elmsford	NY	10019
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way	BLD35	Sleep Hollow	NY	10001
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue	NULL	Yonkers	NY	10002
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue	NULL	Pelham	NY	10002
9	8888555599992222	Tim Horton	4	2	3	1	2028-01-05	25 Sleep Drive	Apt 1	Exton	PA	10958
10	8888777722223333	John Escobar	8	3	1	2	2025-01-07	25 Jump Drive	Apt 1	Exton	PA	10958
11	8888444499992222	Esteban Chulo	12	2	3	1	2025-01-05	12 Eastchester Road	APT 7	Bronx	NY	10623
12	8888444411112222	Steven Bond	6	3	2	1	2025-01-07	12 Westcester Road	APT 254	Yonkers	NY	10623

Listing of **SQL DELETE STATEMENT** used to query the table:

The following **SQL DELETE Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
--New CreditCard Record  for the first delete test

INSERT INTO CreditCard

VALUES ('8888444411112222', 'Steven Bond','6','3','2','1','01/07/2025','12 Westcester Road','APT 254' ,
'Yonkers', 'NY','10623','USA', 10000.00,10000.00,'1' );


--Deleting the New Credit Card Entry

DELETE FROM CreditCard

WHERE CreditCardNumber = '8888444411112222';
```

Table After Execution of **SQL DELETE STATEMENT**:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *

FROM CreditCard;
```

The final state of the **CreditCard table is**

Results Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue
9	8888555599992222	Tim Horton	4	2	3	1	2028-01-05	25 Sleep Drive
10	8888777722223333	John Escobar	8	3	1	2	2025-01-07	25 Jump Drive
11	8888444499992222	Esteban Chulo	12	2	3	1	2025-01-05	12 Eastchester Road

Deleting Record(s) in The CreditCard Table via SQL DELETE Statement

This section shows the test & validates the result of querying the **CreditCard Table** before and after using an **SQL DELETE STATEMENT**.

Table Before Execution of SQL DELETE STATEMENT for Testing & Validation:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *
FROM CreditCard;
```

The current state of the **CreditCard Table** is:

Results | Messages

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode	CreditCardCorporateMerchantBankCode	ExpDate	AddressLine1
1	1111111111111111	John Brown	5	2	8	2	2027-01-25	35 Stevens Street
2	2222222222222222	Snake Plissken	2	1	5	1	2027-02-25	42 Liberty Island
3	3333333333333333	Ellen Ripley	5	3	1	2	2028-03-31	426 Hudson Street
4	4444444444444444	Indiana Jones	2	5	6	3	2028-03-31	1600 Broadway
5	5555555555555555	Mack Turner	1	2	7	1	2028-03-31	777 Seventh Avenue
6	6666666666666666	Han Solo	4	1	5	2	2028-03-31	1138 Millennium Falcon Way
7	7777777777777777	Tom Cody	4	1	5	3	2028-03-31	1984 Streets Avenue
8	8888888888888888	Jim Brown	1	3	2	1	2028-03-25	1984 Streets Avenue
9	8888555599992222	Tim Horton	4	2	3	1	2028-01-05	25 Sleep Drive
10	8888777722223333	John Escobar	8	3	1	2	2025-01-07	25 Jump Drive
11	8888444499992222	Esteban Chulo	12	2	3	1	2025-01-05	12 Eastchester Road

Listing of **SQL DELETE STATEMENT** used to query the table:

The following **SQL DELETE Statements** was used to ***RETURN*** records from the **CreditCard Table**:

```
--INSERT NEW CreditCardProcessingMerchantServiceCompany

INSERT INTO CreditCardProcessingMerchantServiceCompany
VALUES ('13', 'Elavon');

 --Update all records that have the old Credit Card Processing Mercahnt Service Company

UPDATE CreditCard

SET CreditCardProcessingMerchantServiceCompanyCode = '13'

WHERE CreditCardProcessingMerchantServiceCompanyCode = '4';

 --Remove the  CreditCardProcessingMerchantServiceCompany

DELETE FROM CreditCardProcessingMerchantServiceCompany

WHERE CreditCardProcessingMerchantServiceCompanyCode= '4';
```

Table After Execution of **SQL DELETE STATEMENT**:

The following **SQL SELECT Statement** was used to list the content of the **CreditCard Table**:

```
SELECT *

FROM CreditCard;
```

The final state of the **CreditCard table is**

	CreditCardNumber	CreditCardOwnerName	CreditCardProcessingMerchantServiceCompanyCode	CreditCardNetworkCompanyCode	CreditCardIssuingBankCode
1	1111111111111111	John Brown	5	2	8
2	2222222222222222	Snake Plissken	2	1	5
3	3333333333333333	Ellen Ripley	5	3	1
4	4444444444444444	Indiana Jones	2	5	6
5	5555555555555555	Mack Turner	1	2	7
6	6666666666666666	Han Solo	13	1	5
7	7777777777777777	Tom Cody	13	1	5
8	8888888888888888	Jim Brown	1	3	2
9	8888555599992222	Tim Horton	13	2	3
10	8888777722223333	John Escobar	8	3	1
11	8888444499992222	Esteban Chulo	12	2	3

Conclusion

This project was undertaken because EzRental Inc. had hired NYC Tech Solutions to design and implement a suite of Auto Rental Point-of-Sales Management System Applications. This phase of the project was centered on designing, analyzing, developing, testing, and validating the DBMS to ensure it meets all requirements to go live for operations.

This project has key milestones and deliverables presented throughout this document based on the agile methodology the developers selected to follow. These include The Business Requirements, An EER Diagram, The Normalized Logical Model, a Physical Schema Diagram, a Data Dictionary, a Generated Schema Diagram from the creation of the tables, and a tested/validated database.

The Database Developer's job is concluded; the Database Administrator and other IT Professionals, such as the Server Engineering Team, Security, etc., now take ownership of the Operations and Maintenance Phase. The database Architect and Database Developer will re-engage when an upgrade to the DBMS Server Application is required, and the entire development methodology is repeated.