

COMP-3510

Technical Report

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Introduction

With modern requirements faced by utility providers to track the millions of households and businesses they serve; a large movement has been made to change the way companies store customer information. Gone are the days of high-density file rooms, with their massive divisions of clerks and record keepers.

Present day customer management tactics rely on powerful databases on servers that require a fraction of the space and manpower to manage. This project offers a brief insight as to how these databases are designed to provide companies and customers with accurate data regarding services, and related accounting.

Abstract

This assignment has been conducted to better understand the intricacies behind the building of a utility provider database. A specific focus was to build a database that could be used for the tracking and billing of customers by employees of the utility service.

While most utility service providers are required by law in Canada to retain financial records for a total of seven years, a Service Level Agreement (SLA) was laid forth for the purposes of this assignment to maintain a data retention of 6 months. Furthermore, it was maintained that in order to maintain a manageable scope, the database should be prepared to only retain data for one hundred customers, and three service providers.

While the intricacies for a service providers database is always adapting to government regulations, management demands, and employee needs; it was decided that only basic functionality should be achieved for the purposes of this assignment.

Entities

While the basic entities can be deducted to be the customer, service provider, invoice, account and utility; upon closer inspection it was deducted that no less than thirteen entities were required to achieve basic functionality while maintaining a third degree of normalization.

The first entity to be discussed is the Customer entity. The customer purchases a utility service through their account with the service provider. The customer has a customer identification number (Primary Key), a first name, and last name which are used to easily identify them within the database. The customer information also contains a primary email and primary phone for ease of contact. It was debated that separate entities could have been made for both the phone and email attributes, however for the scope of this assignment it was decided that to achieve basic functionality that only one of each was needed per customer. The customer table also maintains a billing preference which is used to record if the customer chooses to have their invoices and other documents sent to them by email or postage. The final attribute of the customer table is the customer address, however it was quickly noted that many customers could have more than one address. It was upon this discovery that it was decided that the customer address should be maintained as a separate entity.

The Customer Address is identified by its primary key customer id, and address description. This entity contains the attributes of street number, street name, postal code, city, country, and region id. It was also noted that several customers at remote locations would not have a proper address; with this being the case, it was decided that additional attributes should be allocated for the recording of longitude and latitude of a customer’s service. The customer address provides a detailed description of where the customer is located, however it should be noted that service providers often service vast expanses of area. It was with this in mind that the next entity Region was conceived.

The region serves to provide the segmentation of large land areas, which allows for service providers to organize their employees into regional offices to better provide services to customers. For the scope of this assignment it was decided that as a whole the focus should be on Canadian services, with the regions being divided by provincial and territorial boundaries. The region can be identified by it’s primary key of region ID; and contains attributes for the region name, and the tax rate for that region.

It was further deduced that a service provider could offer several utilities to it’s customers. For example, Enbridge branches out from oil and gas products to also supply energy via wind and solar. It is with this in mind that the entity Provider Service Regions was created. This entity is used to track services provided in each region through it’s primary key Service ID, this key is unique to each utility offered in each province. This entity also maintains the attributes of region ID, the ID number of the utility provided, and the business number of the service provider selling that utility.

Another large entity is the Utility Provider; these are the businesses responsible for providing customers with services. The utility provider can be identified by it’s business number (Primary Key), also known as it’s incorporation number. This entity contains information on where the head office is located, as well as the main phone and email address for the head office. While it was discussed that a separate entity could yet be outlined for addresses and contact information for all the regional offices and employees; it was decided that for the scope of this assignment only the main office was required. Furthermore, an interest rate for late payments is also maintained by this entity, for the purpose of computations for customer accounting.

The Utility Providers provide services denoted by service regions, however these service regions can not be defined without the Utility entity. This entity is defined by it’s primary key Utility ID, and contains the simple attributes of a description, cost, and measurement units for that utility.

These utilities are measured using meters supplied by the service provider. The Meter entity has a unique id (Primary Key), and contains the account in which it is tied to, and the service ID of the service region in which it is tied to.

All the above entities would be useless without the main driver behind this database, which is the generation of capital. The utility provider must sell services to customers in order to generate capital, so that the business can properly function. This generation of capital is only made possible by customers holding an account with the service provider they wish to buy utilities from. The Account entity is identified by it’s primary key, Account number. This entity maintains important attributes used to track the customers financial information such as bank accounts for direct deposit, and credit card information. Other attributes include important dates such as the service start and end dates as well as the date of the next invoice. A customer ID is also tied to each account, alongside their account balance and if they have an overdue payment.

While the account tracks the big picture financial standings a separate entity is supplied for the tracking of incoming and outgoing funds. This entity is denoted as Account Transactions, and is denoted by it’s primary key Transaction ID. The attributes stored by this entity include a transit number from the banking institution, invoice number, amount, and account number. This allows utility providers to place a debt on the customer's account, and the customer to make payment to their account.

In order for the customer to make payment to their account they must first be made aware of the amount they owe; this is why companies issue invoices to their customers. The Invoice entity is uniquely identified by it’s primary key of Invoice number, and contains attributes for due date, account number, issue date, and total.

It was noted that often times customers may owe funds for more than one item. For example the utility provider may have an installation fee, and also bill the customer for their first month. With this in mind, the entity Invoice Item was produced. This entity is identified by the primary key Line Item, and contains the invoice number in which it is tied to as well as the quantity of the item being placed upon that invoice.

The Line Item entity is the service provider’s tool for storing any items they sell. This entity uses a line item ID as it’s primary key, and maintains attributes for cost, and description. The optional entity of utility ID is also used to record if the customer purchased utility that month.

Views and Procedures

Although there is a plethora of views that might be utilized by utility companies, it was determined that approximately five views made up the backbone of a successful utility provider database.

The first of these views are the accountant summary, which allows the accountant insight into the financial standings of a customer account. The accountant view provides the user with a brief customer description including the account number and balance, as well as information pertinent to mailing invoices. This view also provides the accountant with a summary of invoices over the course of six months; an SLA that was laid out by the deign constraints. This invoice summary only provides the most pertinent information for account maintenance including invoice numbers, sub-totals, taxes, and invoice totals. This view only provides an at a glance view of each account, but the accountant can this information to dive deeper into an account.

This deeper dive into an account comes with the “Invoice View” which pools the data required to build an invoice. This information includes the invoice number, customer’s name, mailing address, line items, sub total, taxes, and totals. The line items are further broken down into the provider specified ID, a description, unit cost, quantity, and total line costs. This view will not only allow for employees of the appropriate company and position to view invoices, but will also allow for an automated system to generate and print invoices to be mailed to the customer.

An alternative view dubbed the “Customer Summary”, provides employees such as customer service representatives the ability to quickly access important information for a customer in events such as a customer calling in to settle a dispute. This view provides important customer data including the customers name, address, account balance, and contact information. This data is used as a header for the customers utility information including the meters tied to their accounts and the monthly usage recorded by these meters. This view also provides the invoice summaries for each month including the invoice number, sub total, tax, and total. All of the data in this view is organized to take into account the six month data retention laid out by the design SLA. While this view is a useful tool to employees, it can also be used to prepare a customer portal, in which customers will be able to confirm the validity of their own information, as well as view their monthly usage and invoice summaries.

This view can also be modified further, to remove the invoice information in an almost identical view called the “Customer Service Summary”. This view is for low level service employees such as technicians, who do not require any invoice information. This view allows the user to be able to find and service customers by providing a list of meters, the address they can be located at, and their usage for the most recent month. This information is integrated with the account number, customer name, and customer contact information. The decision was also made to provide the account balance in this view as well so that the user can determine if the customer is in good standing and meet their SLA for unpaid accounts.

The final view prepared, is the “Manager’s View” which provides a brief outlook on the big picture of the company’s operation. This view can be broken down into two portions; the first of which is the region performance. This region performance organizes data under the region name, to show the number of meters, average usage, total usage, average income, and total income for each region. The second portion of this view is outstanding balances, which allows for the quick overview of customers with outstanding payments. This section includes the customer name, account number, amount outstanding, the last payment amount, and the date of their last payment. This view will allow the manager to make appropriate decisions on things such as new infrastructure and customer cancellations.

Conclusion:

The design of a utility service provider’s database will vary between companies; however, it is our opinion that a general backbone of data has been laid out within this assignment. Next steps for this project would be the general automation of data such as the pulling of usage from meters to generate financial data, the automatic halting of services to overdue accounts, and automatic conducting of invoices. Furthermore, further views can be constructed to allow further tiered access to employees, and the meeting of any government reporting requirements.

While the design of this database may be rudimentary in comparison to those of a professionally curated database; it can be deduced that the groundwork for a functional database has been laid. It is our opinion that the main functionalities of these types of databases will truly shine when there is the appropriate data collection entities in place (ie. meters) and this assignment has served its purpose in educating us on the mindset to hold when designing databases as professionals in the future.