The Florida State University
College of Arts and Science

A Telecom Billing Application

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October 30th, 2003

A master project submitted to the
Department of Computer Science
In partial fulfillment of the requirements for the
Degree of Master of Science

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Major Professor

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Committee Member

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Committee Member

Abstract

In this project, I have designed a Billing System for a Phone Company using ASP, JavaScript, MySQL as the database and MD5 encryption of passwords and other sensitive user data.

The billing system provides user-interface to maintain user accounts for Phone billing purposes. The features of this Billing System on the Client Administration side includes Client Registration, Price Quotes, Printing monthly Invoices, Receive Payments, Adding Credits, Lock-Unlock Customers and Lookup Customers. On the Administrative side, features include adding/Editing Roles, Employee, Company Location, Add-on Features Monthly Plans etc,. It also has a built-in Report system to provide useful report of the company such as financial reports, Receipt Reports, Monthly Invoice Reports, Tax Reports, Customer Service History Report etc,.

The application is not company specific or database specific. It is built as a sellable product with minimal change to the code. The application is based on the client-server model. The application provides transaction safe capability, if the database is transaction safe. The application has a login feature to protect un-authorized access.

This project is dedicated to my parents and my brother, without whose support I wouldn't have considered getting a Masters degree. My parents are my backbone and I appreciate all that they have done for me. My brother, Hemanth challenges me to keep me on my toes all the time.

ACKNOWLEDGMENTS

Dr. Robert van Engelen is my major professor. I learned a lot from working with him on this project and by attending his classes. I want to thank him for approving this project as my Masters project.

Anton Haducek is my project manager at Sphyrna Inc. His fabulous ideas have made this project a success. His vision of future for this application has made the billing system generic. I consider him to be my mentor. I appreciate his guidance and support.

Finally, I want to thank Dr. D. Schwartz and Dr. L. Hawkes for agreeing to be on my masters project defense committee.

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1. Introduction

This Billing package is a comprehensive billing package for Phone companies.
It offers ease of day-to-day operations, superb client management, a whole suite of useful managerial reports, seamless system administration and report generation.

Phone services are one of the basic amenities around the world. They have huge customer bases. This makes it imperative for a billing system aimed at a phone company to be well designed, tested, and free from most security holes. Most of the billing system suffers from being company specific. This billing package overcomes this by being as generic as possible.

This Billing system has been designed keeping in mind a large customer base. It provides hierarchical based system (Roles) to customize to different level of users. This insulates different users of the billing system and provides its own security.

This billing system has been tested on databases like MySQL (Windows and Unix BSD) and SQL SERVER. It can also be attuned to the company needs. The billing system provides transaction safe capabilities. It also provides database setup software, which makes it easy to create all the required tables.

The billing system has authenticated login and logout capability to provide extra capability. It provides capability of printing and reprinting of Monthly invoices. This enables verification of client balance information.

2. Requirements

There are lots of requirements for a phone billing system. One of the key requirements is ease of use. It has to be designed in such a way that even a person with basic knowledge of computers can operate it with relative ease. It should be self-explanatory. It should be able to handle large customer base. The billing system must be generic. It should be database independent. It should be operating system independent. It should be expandable in future. It should be designed as a marketable product.

The billing system must be able customize different roles for different user needs. It should have a login system. The passwords must be encrypted when transmitted from client to server and vice-versa. The billing system must be accessible using a browser.

The billing system must provide reports as collection of important information. Some of the typical reports are financial reports, monthly invoice reports, tax reports etc.

The bills must be payable by credit card, check or cash. The credit card information must be encrypted when and if stored in the database. It should be easy to access a customer's information. It should also be able to store and retrieve customer service information. Simultaneous use of this billing system should not be hindrance and all data must be accurately stored.

Since the nature of a phone billing system is such that some of the parameters like taxes, surcharges, employee etc change, this information must be editable. The same billing system must be able to run from different locations connected to the same database. The customer information shouldn't be accessible to all users of this software. Last but not the least the there must be a mechanism provided to print monthly invoices.

3. Installation Guide

3.1 Server Side setup

Put all the asp files in a folder say "Tiburon" on a server named "shark". Make the Tiburon folder web shared. The URL for the billing system is http://tiburon.sphyrna.com.The folder must be enabled for ASP. It must have permission to read, write and execute ASP.

3.2 Database setup

Once you've installed MySQL (from either a binary or source distribution), you need to initialise the grant tables, start the server, and make sure that the server works okay. You may also wish to arrange for the server to be started and stopped automatically when your system starts up and shuts down.

Normally you install the grant tables and start the server like this for installation from a source distribution:

shell> ./scripts/mysql_install_db

shell> cd mysql_installation_directory

shell> ./bin/mysqld_safe --user=mysql &

For a binary distribution (not RPM or pkg packages), do this:

shell> cd mysql_installation_directory

shell> ./scripts/mysql_install_db

shell> ./bin/mysqld_safe --user=mysql &

The mysql_install_db script creates the mysql database which will hold all database privileges, the test database which you can use to test MySQL, and also privilege entries for the user that runs mysql_install_db and a root user. The entries are created without passwords. The mysqld_safe script starts the mysqld server. (If your version of MySQL is older than 4.0, use safe_mysqld rather than mysqld_safe.)

Once the grant tables are setup, Create a database user. Using the database setup software provided with this billing package, create all the required tables.

3.3 Server Requirements

Minimum requirement for the server as tested is Microsoft Windows NT, 10 GB, 400 Mhz, IIS 4.0 and above, Mysql 4.0(Unix or windows) and above

4. Technology

The server technology used is Active server pages (ASP). Microsoft Active Server Pages (ASP) is a server-side scripting environment that you can use to create and run dynamic, interactive Web server applications. With ASP, you can combine HTML pages, script commands, and COM components to create interactive Web pages or powerful Web-based applications, which are easy to develop and modify. ASP is easy to program and relatively secure. It provides good database connectivity. It provides developer productivity, application performance, reliability, and deployment.

One of the challenges faced by Web developers is how to create a coherent application out of a series of independent HTML pages. This problem is a particular concern in Web development because HTTP is a stateless protocol. Each browser request to a Web server is independent, and the server retains no memory of a browser's past requests. The HTTP 1.0 protocol did not provide a mechanism to maintain state information between requests from a browser.

To overcome this limitation, application developers require a technique to provide consistent user sessions on the Web. Active Server Pages (ASP) provides powerful and flexible Web session management that requires no special programming. The Session object, one of the intrinsic objects supported by ASP, provides a developer with a complete Web session management solution. The Session object supports a dynamic associative array that a script can use to store information.

Active Server Pages (ASP) technology is language-independent. Two of the most common scripting languages are supported right out of the box: VBScript and Java Script. Support for other scripting languages, such as Perl, is available. Whatever scripting language you use, you can simply enclose script statements in special delimiters for ASP. The starting delimiter is **<%**, and the closing delimiter is **%>**.

Most of the functionality you can build into an ASP page comes from objects on the server. IIS 4.0 comes with some built-in objects, as well as a number of installable objects. You can also use objects created by a developer you know, or create and use your own objects.

5. Design

5.1 Application Design

The billing system will be mainly divided into four categories. Client Administration, Add New Parameters, Edit and Reports. It will have a logout capability.

- Client Administration will allow the user of the application to add new customer, give price quotes, edit customer phone #, edit client monthly plan, lookup account, receive payment, add charges, create monthly invoice, create monthly invoice by bill cycle, add credit and lock-unlock customer.
- Add New Parameters will involve adding new Add-on features, new locations, new monthly plans, new initial set-up non-recurring charge (ISNRC), new taxes, new surcharges, new county, new employee, new role and finally new additional charges. These features are accessible by administrators. But the billing system design provides the flexibility to allow lower level users to access the above features. Roles can be created for different levels of users. Employees are assigned different roles. This allows the admin to restrict some employees from accessing sensitive data.
- Edit parameters will allow editing add-on features, editing locations, edit monthly plans, edit ISNRC, edit taxes, edit surcharges, edit counties, edit employee, edit roles and finally edit surcharges. These features are accessible by administrators. But the billing system design provides the flexibility to allow lower level users to access the above features.
- Reports are designed to retrieve concise user information. This section includes Account report, Non Payment Report, Customer Service form, Customer Service History report, Customer History Report, Employee-Location Report, receipt Report, Monthly Invoice Report, Tax Reports, Surcharge Reports and Financial Reports

5.2 Database design

The database setup is made easy by software that is provided with the billing system. Before using the software to create the tables, database software like MYSQL or MSSQL has to be installed and setup. Then a database and user having access to this database is created. Once this is done, the database setup software would need information like database name, database user name, password and the Ipaddress of the database location. The software creates all the tables required by the billing system. The required data to make the billing system operational is also inserted into the tables by the software.
The tables created are of type Inodb. The reason for using this particular type is that it is the most reliable transactional table type available. The database is designed to follow the first three Normal forms.

6. Implementation

It was decided to use ASP as the server side scripting language and java script for client side scripting. The reasons are availability of software, ease of use and familiarity. The connection to the database is made once for each user session. Connection to the database is made as follows

```
<Object
 runat="Server" scope="Session" id="connection" progid="ADODB.C      onnection">
</object>
```

Once the connection is made, the id is used to retrieve the data from the tables. Here is an example.

```
<%
Set RS=Connection. Execute ("select field1 from table1 where id = '100'")
%>
```

Once the SQL query is executed, you can retrieve th   e data corresponding to that particular field by

```
<%
Do While Not RS.EOF
response. write  & RS("field1")
RS.MoveNext
Loop
%>
```

On the client side scripting, the following example makes sure that the user data entered has a particular pattern.

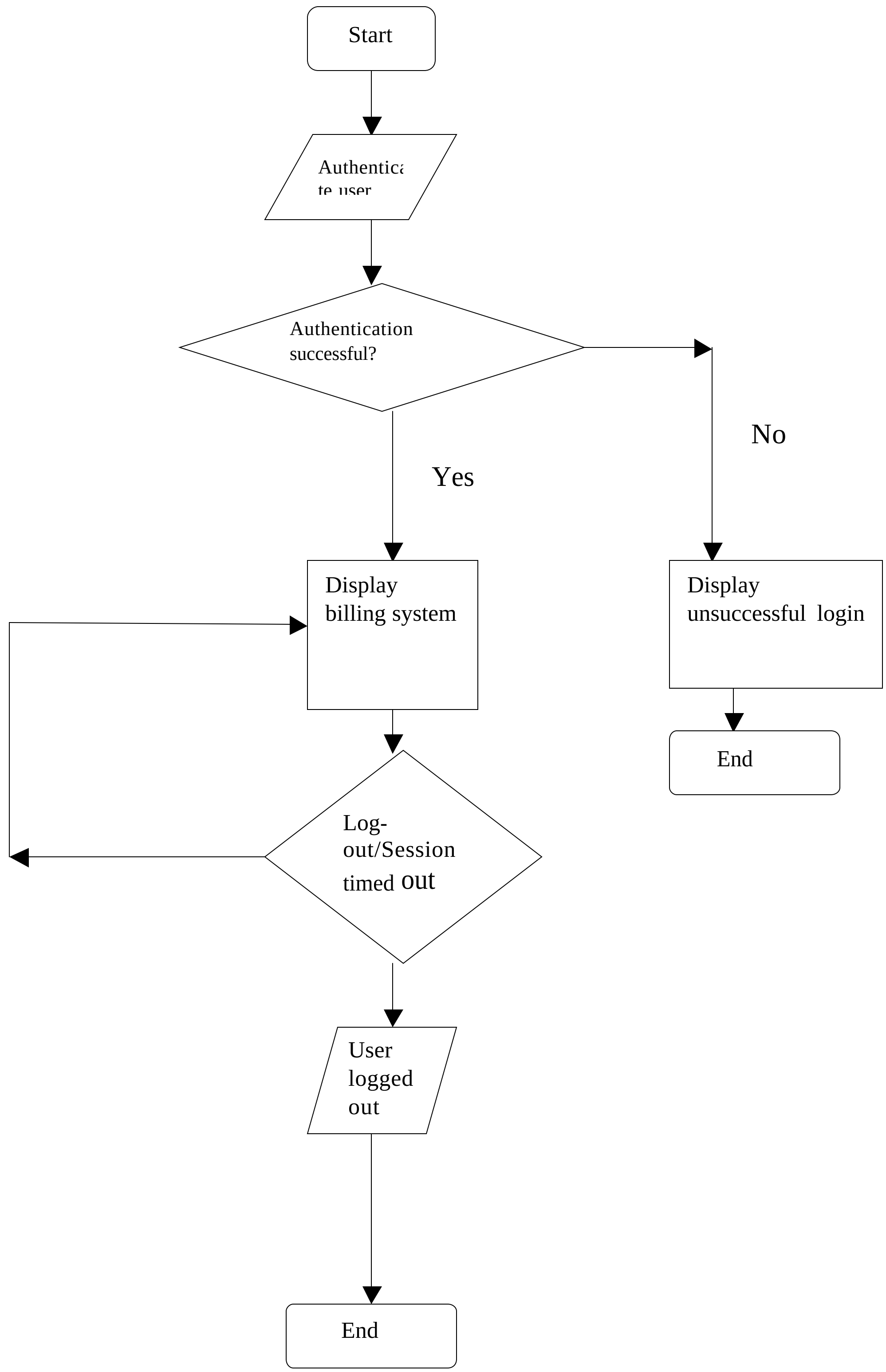
```
var regexp = /^ ([a-zA-Z0-9]{9,}$/;
var str = field1.value;
```

```
if (str.match(regexp))

{

return true;

}

else

{

Alert ("Please enter only letter and numeric characters for field1.");

Field1.focus();

Return false;

}
```

Retrieving information from a form submit is done as follows. If the variable being passed is say “var”, then using request.form data stored in the variable is retrieved.

```
<%

dim temp

temp = request.form ("var")

temp = Replace(var,"'","`")

%>
```

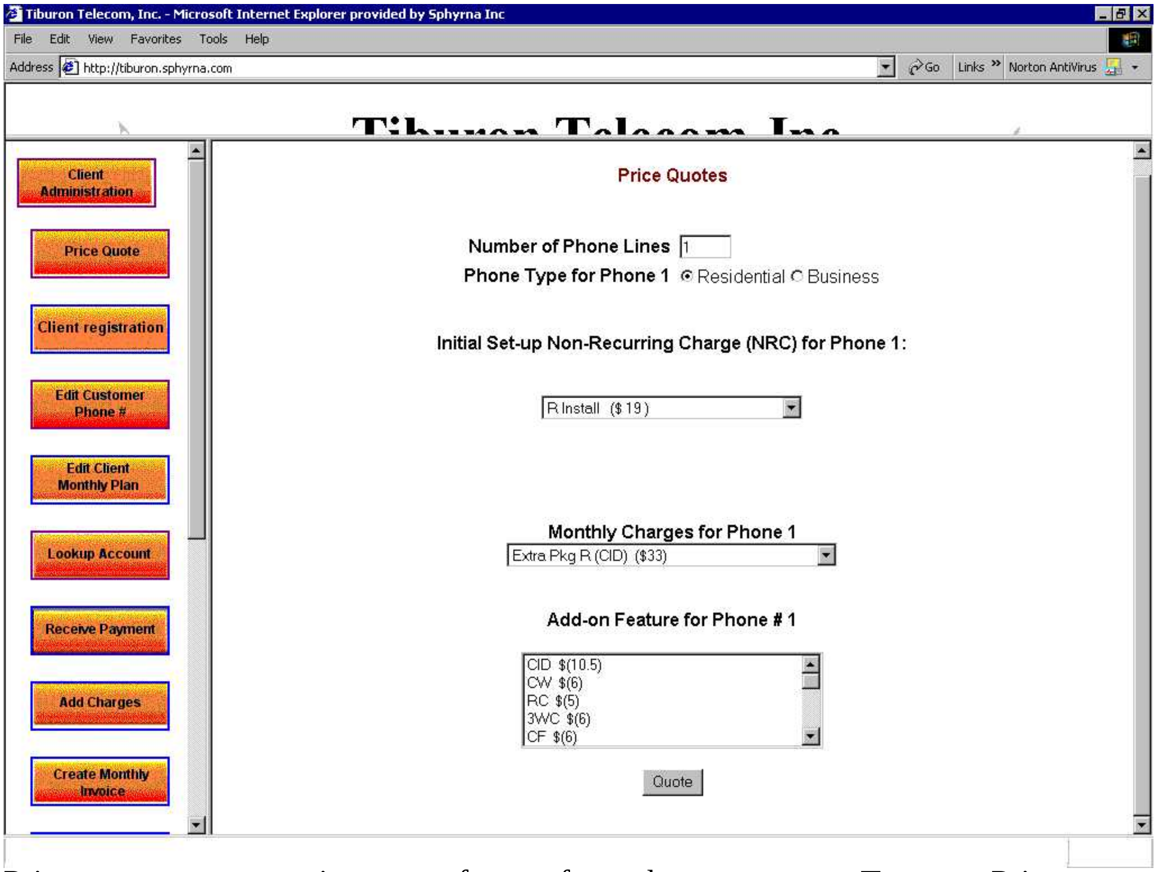
Flow Chart:


Start
Authentica
te user
Authentication
successful?
No
Yes
Display
billing system
Display
unsuccessful login
End
Log-
out/Session
timed out
User
logged
out
End

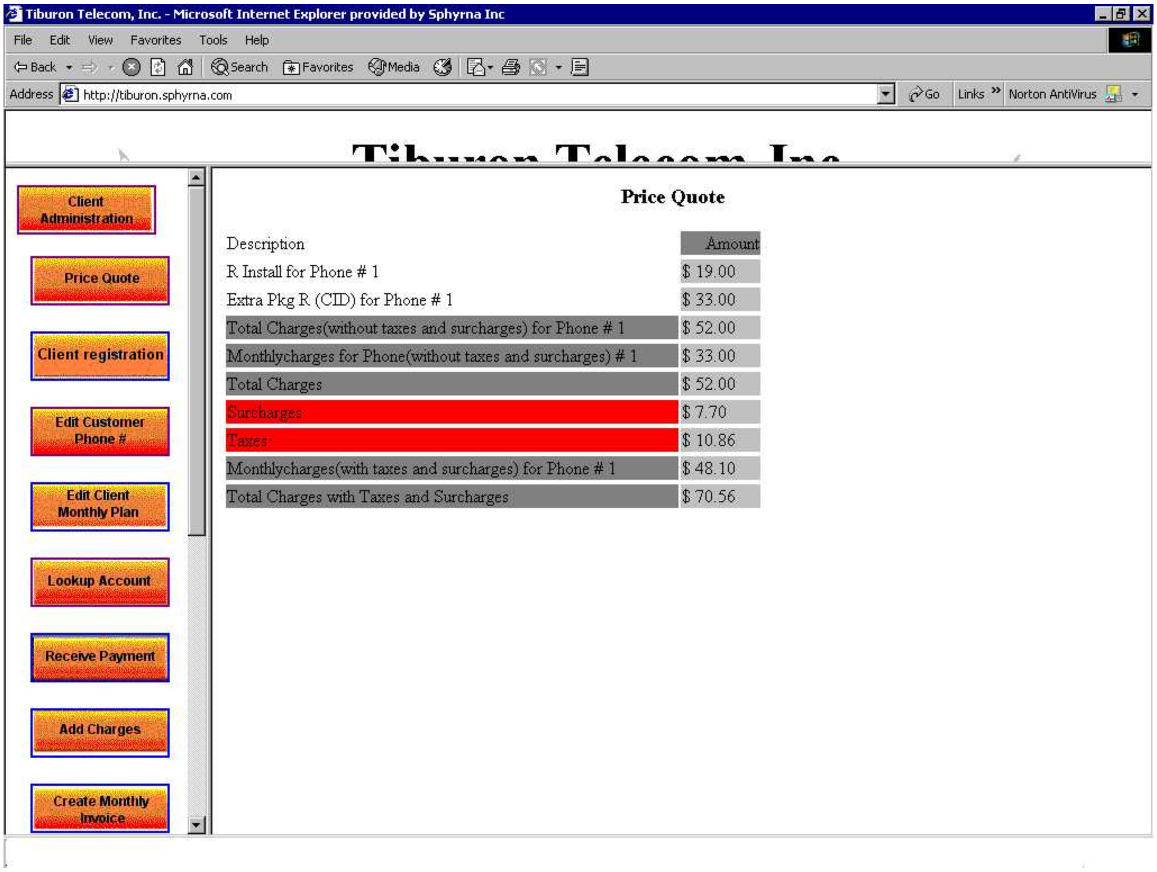
7 User manual

7.1 Client Administration

7.1.1 Price Quotes

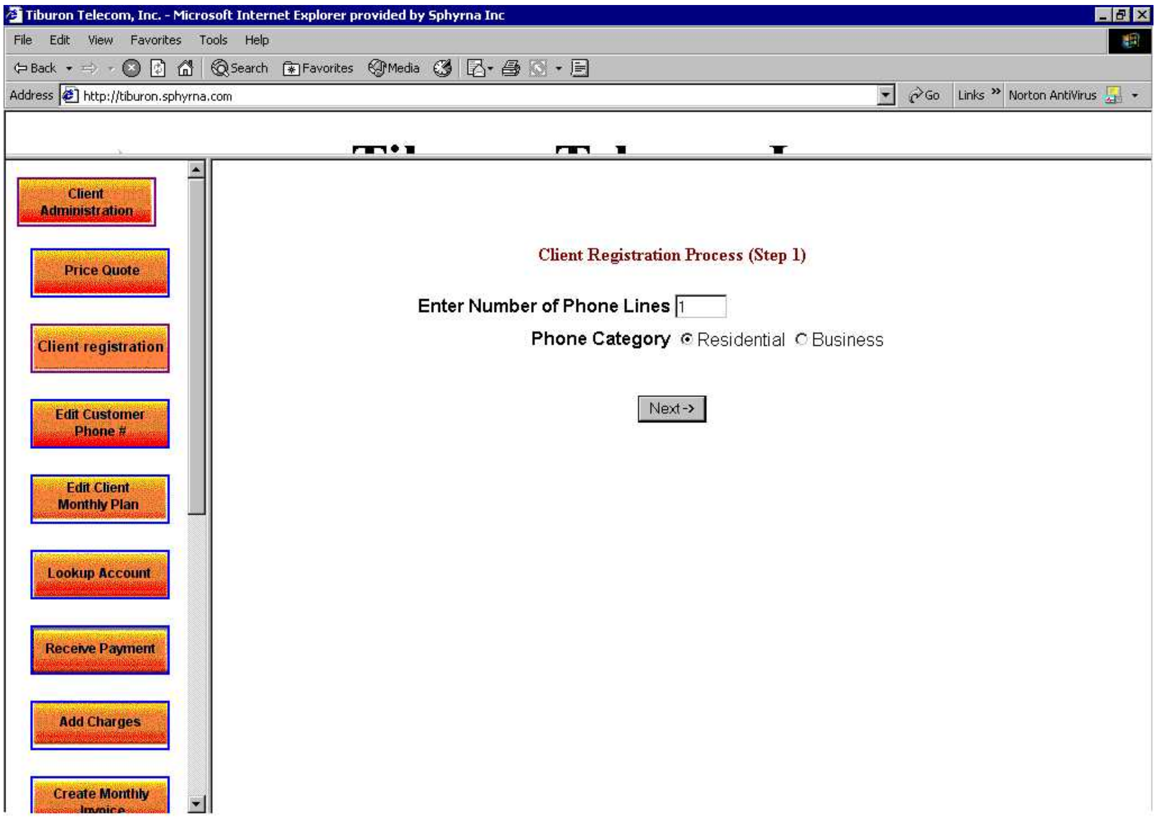


Price quotes are a very important feature for a phone company. To get to Price quotes click on Client Administration->Price Quotes. Enter a positive number for number of lines. Select Residential or Business for phone type. Note Residential and Business phones have different surcharges. Select an Initial set-up Non-Recurring charge (ISNRC), Monthly plan and Add-on feature for each phone line. Click Quote. You should see a screen similar to the following screen.

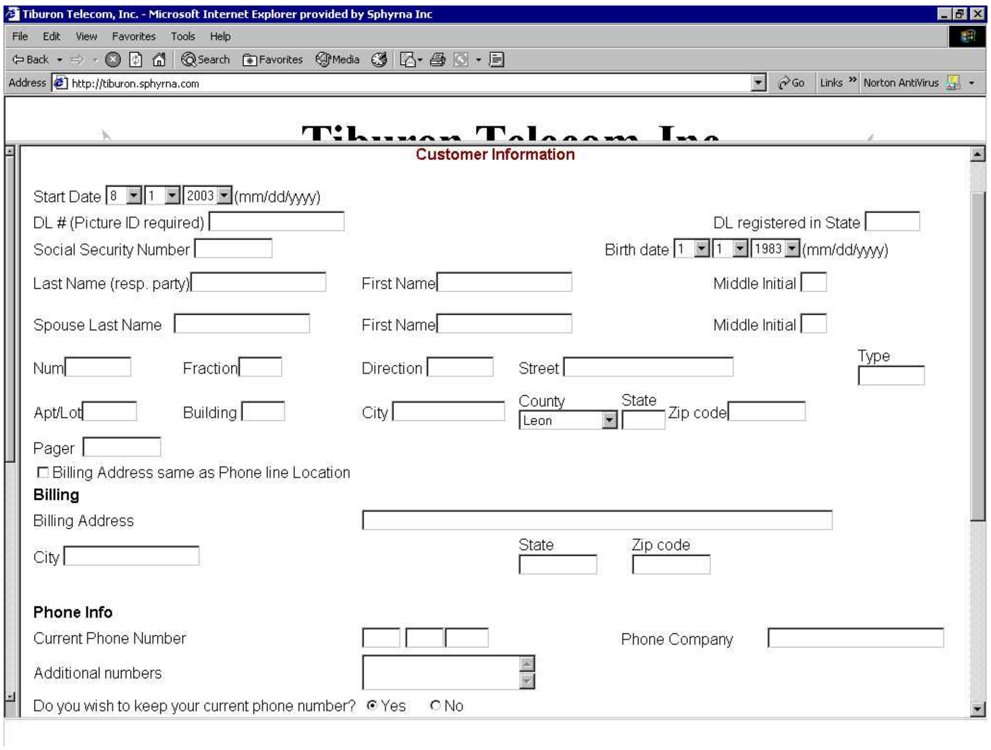

Tiburon Telecom, Inc. - Microsoft Internet Explorer provided by Sphyrna Inc
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://tiburon.sphyrna.com
Go Links Norton AntiVirus
Client Administration
Price Quote
Client registration
Edit Customer Phone #
Edit Client Monthly Plan
Lookup Account
Receive Payment
Add Charges
Create Monthly Invoice
Price Quote
Description
Amount
R Install for Phone # 1
$ 19.00
Extra Pkg R (CID) for Phone # 1
$ 33.00
Total Charges(without taxes and surcharges) for Phone # 1
$ 52.00
Monthlycharges for Phone(without taxes and surcharges) # 1
$ 33.00
Total Charges
$ 52.00
Surcharges
$ 7.70
Taxes
$ 10.86
Monthlycharges(with taxes and surcharges) for Phone # 1
$ 48.10
Total Charges with Taxes and Surcharges
$ 70.56

7.1.2 Client Registration

To get to Client Registration click on Client Administration->Client Registration. Client Registration is a five-step process. First, Select the number of phone lines and the phone category (Residential or Business). Number of phone lines is a positive number.

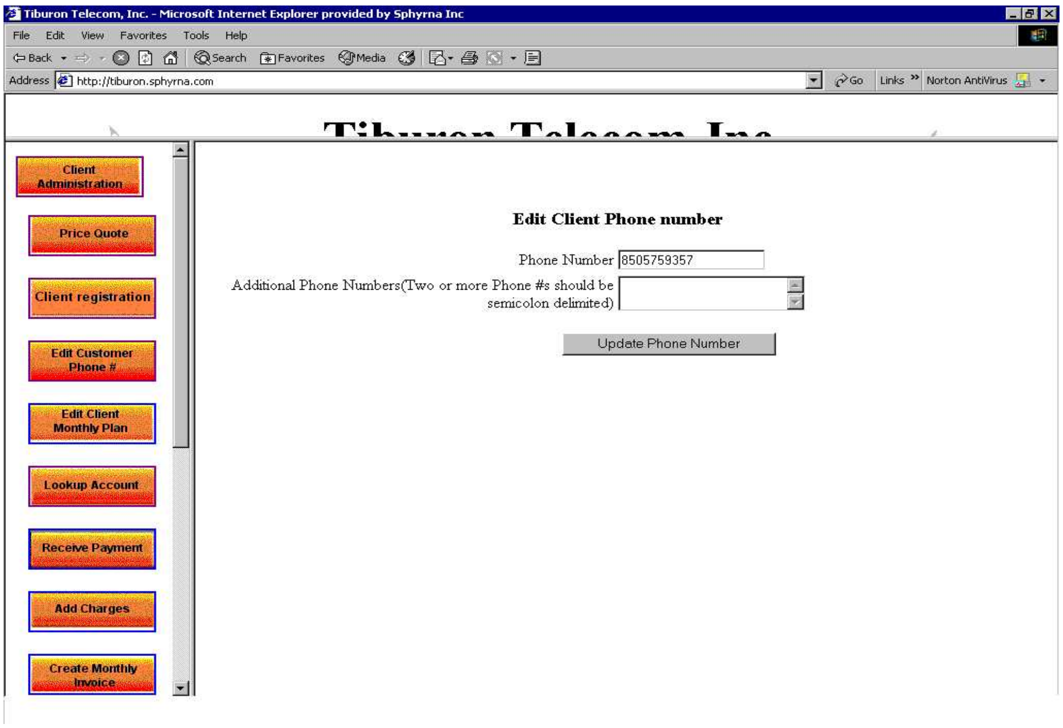


The second step is to select Initial Non-Recurring Charge (ISNRC) for each phone line. Next, select the monthly plan for each phone line. The forth step is to enter customer account information. The last and final step is to receive payment. The payment is payable by installments. First check if the customer account information is accurate. To receive payment by installment, check “pay ISNRC by installment”. Enter installment period in months (a maximum of 6 months). Select a mode of payment (MOD). If MOD is “check”, enter check # and name of bank. If MOD is “Credit card” then enter credit card information and credit card type. Then enter a reason for receiving a payment. Once you receive the payment, the first monthly invoice and receipt of payment is printed. Print two copies of it, a company copy and a customer copy.



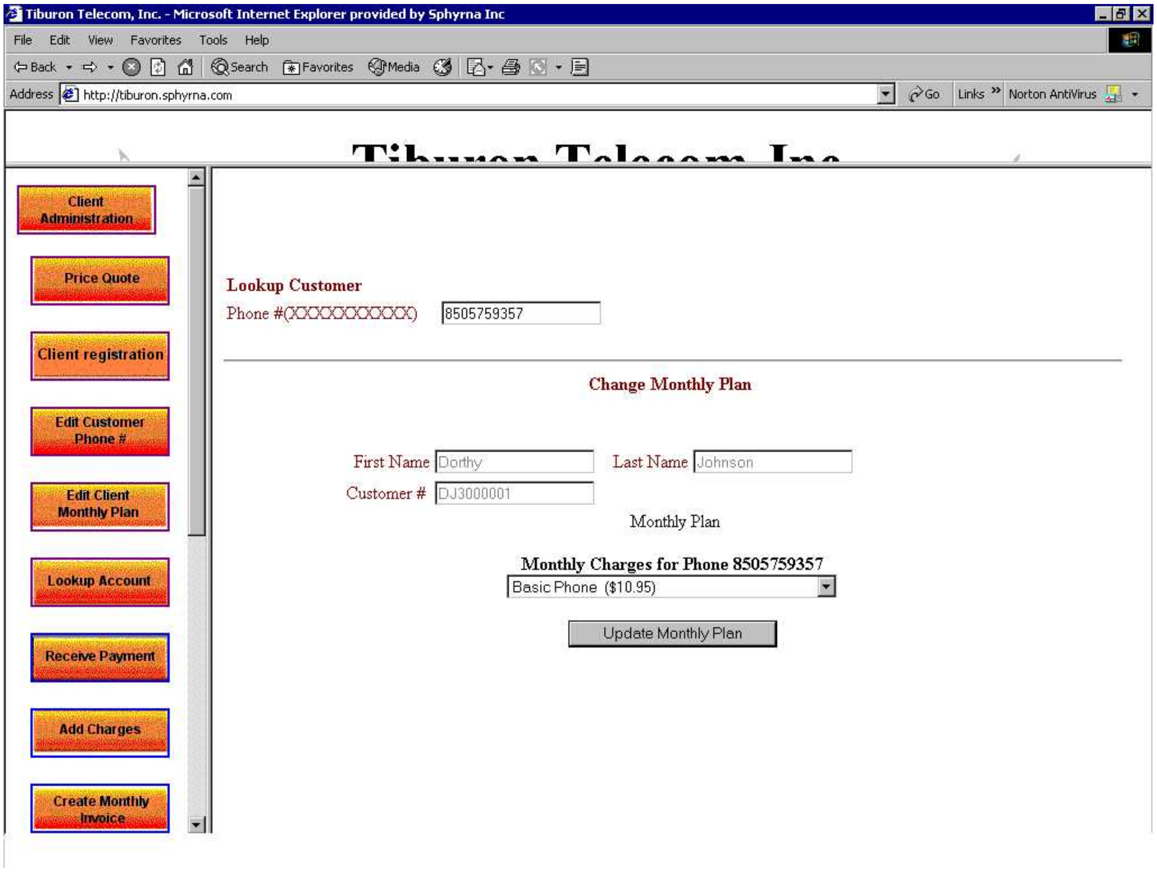
7.1.3 Edit Customer Phone

Typically when a new customer is added it takes two-three days to get the phone number for the customer, due to all the administrative work involved. So use this feature to add a new phone # by selecting the customer #. Put the new phone number in the following screen.



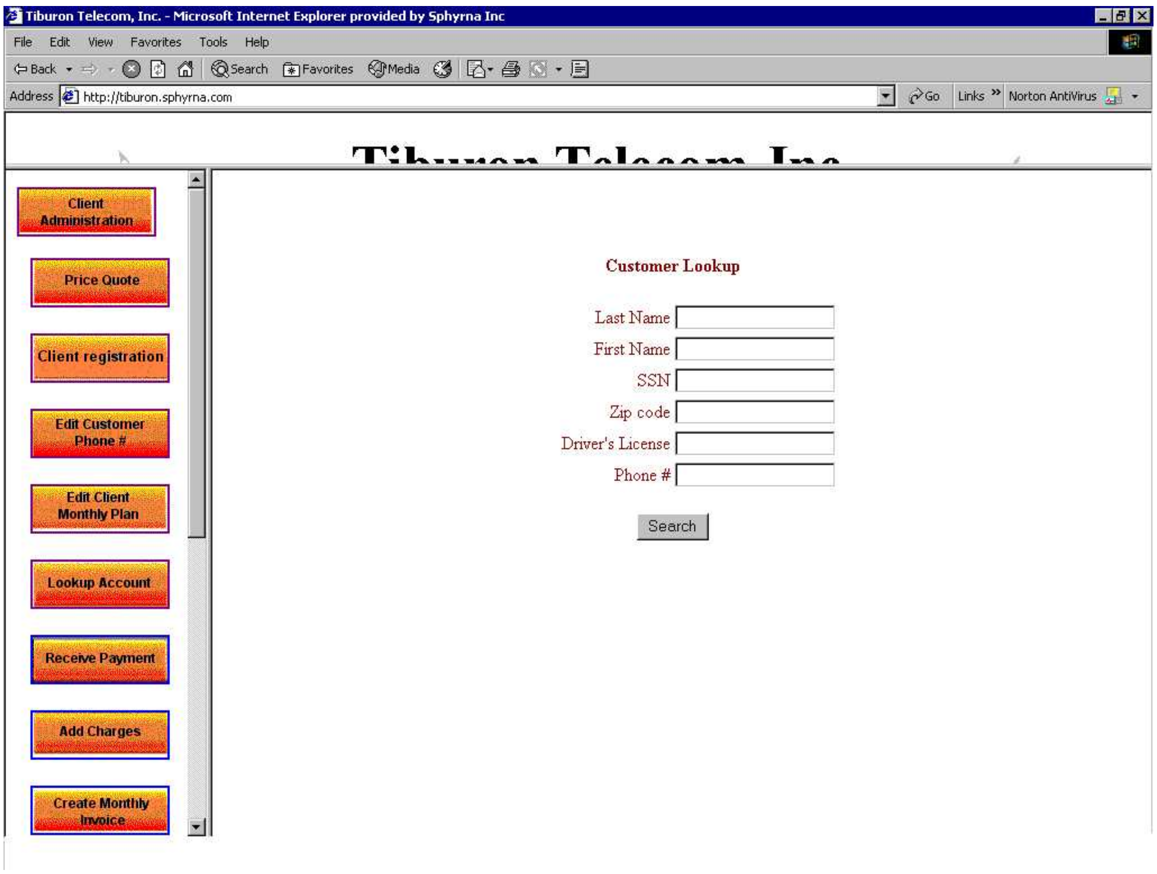
7.1.4 Edit Client Monthly Plan

Use this feature to change the monthly plan of the customer. First use lookup by phone number to get the customer Monthly plan information. Then select a new monthly plan. A credit or a charge will be added using a prorated formula.



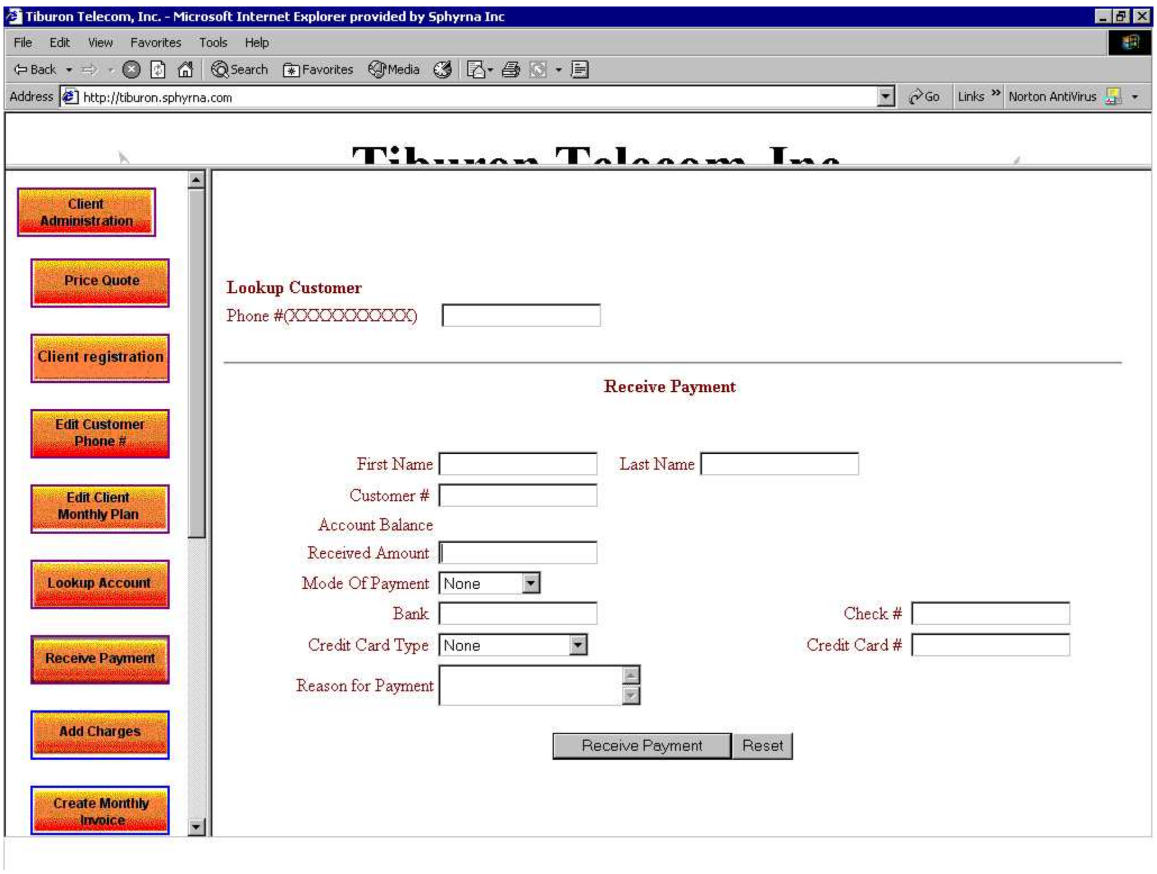
7.1.5 Lookup Account

Customer lookup can be done by entering first few characters of First name or Last name or SSN or DL or zip code or Phone #. The SSN and DL information is encrypted before comparing. After a successful lookup, and if the Employee has access to edit customer information, he can click on "Edit Customer" to edit the customer information. One can also look for customer service information for each customer.



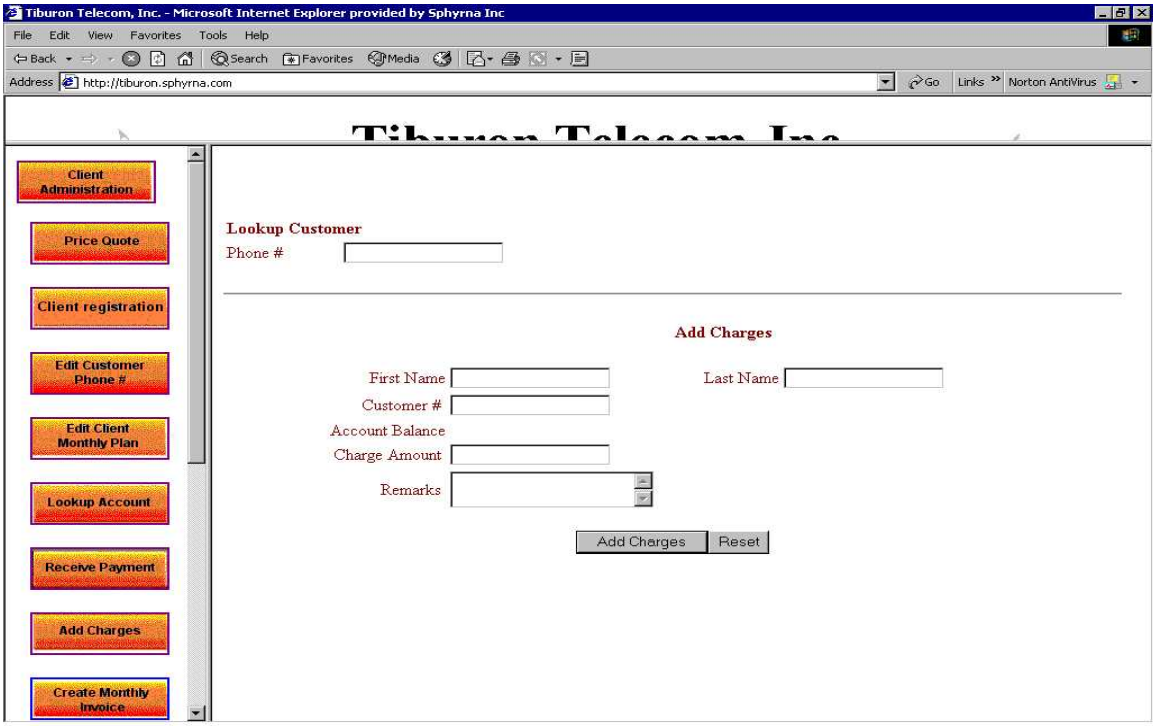
7.1.6 Receive Payment

To receive payment click on Client Administration->Receive Payment. First using Customer lookup, the customer information (first name, last name, balance) is retrieved. Enter the “received amount”. Select a mode of payment (MOD). If MOD is “check”, enter check # and name of bank. If MOD is “Credit card” then enter credit card information and credit card type. Then enter a reason for receiving the payment. Once you receive the payment, a receipt of payment is printed. Print two copies of it, a company copy and a customer copy.



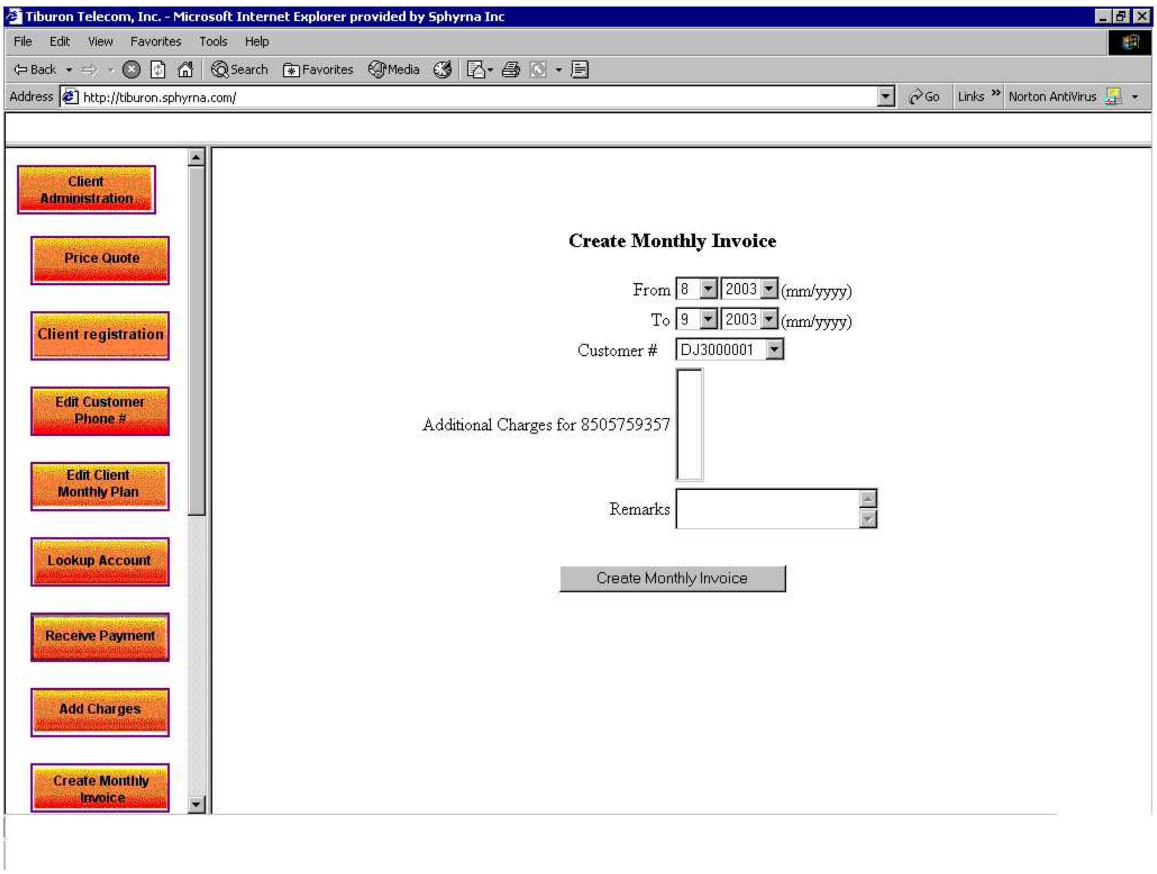
7.1.7 Add Charges

To add a charge, lookup the customer information, by entering the phone number. Enter the charge amount and a remark for the charge.



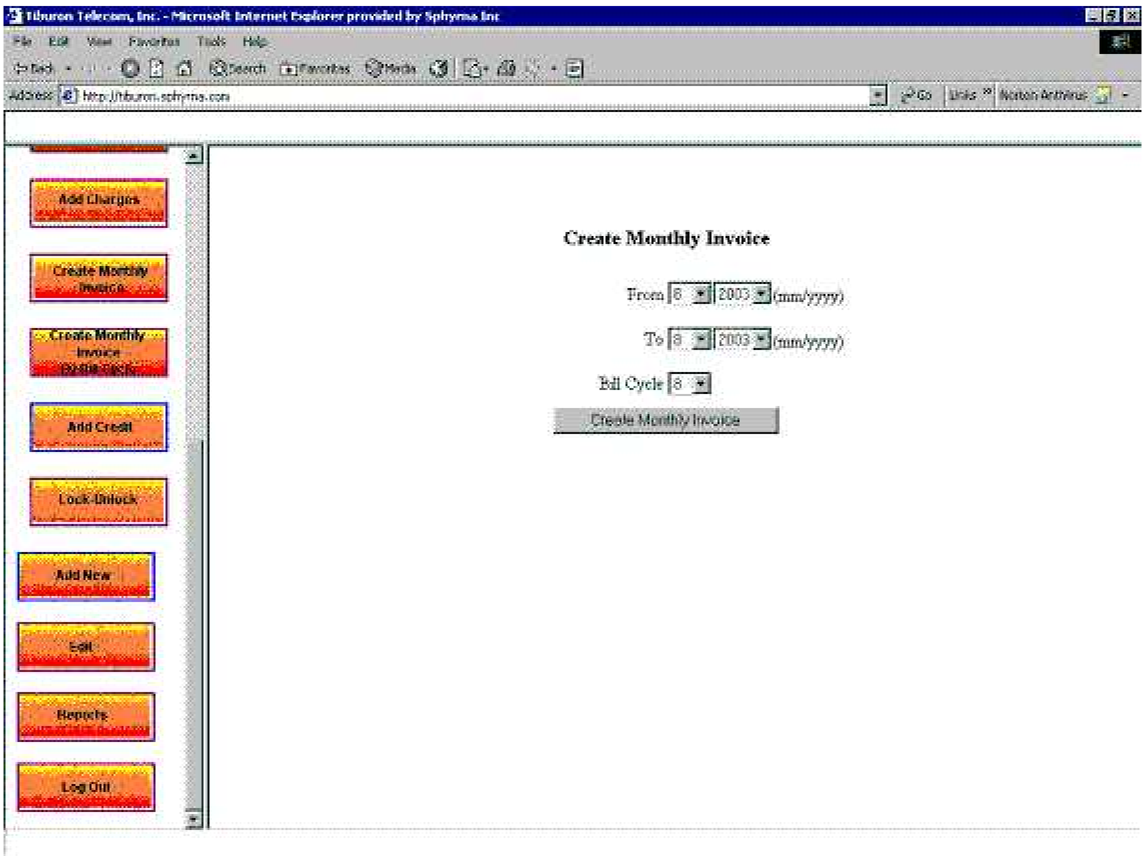
7.1.8 Create Monthly Invoices

To create a monthly invoice for a customer, choose the start date and end month/year of the customer. Choose the customer #. Then select additional charges for the chosen time period (if any). For information on adding additional charges please look under "Add new additional charges". Enter a remark for the monthly invoice. Click on create monthly invoice. Print two copies of the monthly invoice. Note monthly invoice for a particular month can be created only once. If the invoice for a month is already created then a message saying the same is displayed.



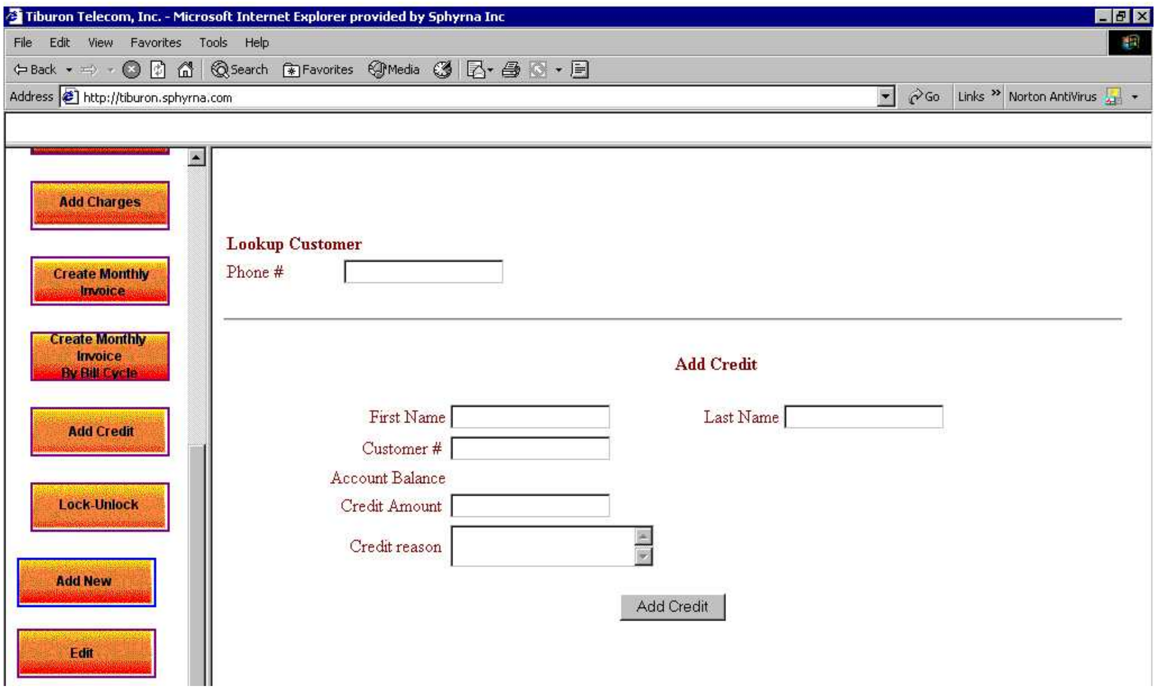
7.1.9 Create Monthly Invoices by Bill cycle

Every Customer falls under a billing cycle. This feature eases the creation of monthly invoices for many customers at a time. Select the start time and end date. Choose a bill cycle. Then click create Monthly invoice. A monthly invoice for each customer for the selected time period is displayed. Print two copies of monthly invoice for each customer.



7.1.10 Add Credit

To give credit to a customer, look-up the customer first name, last name and balance by using the Customer lookup. Enter credit amount and credit reason. This credit will show up on the next monthly invoice for that customer.



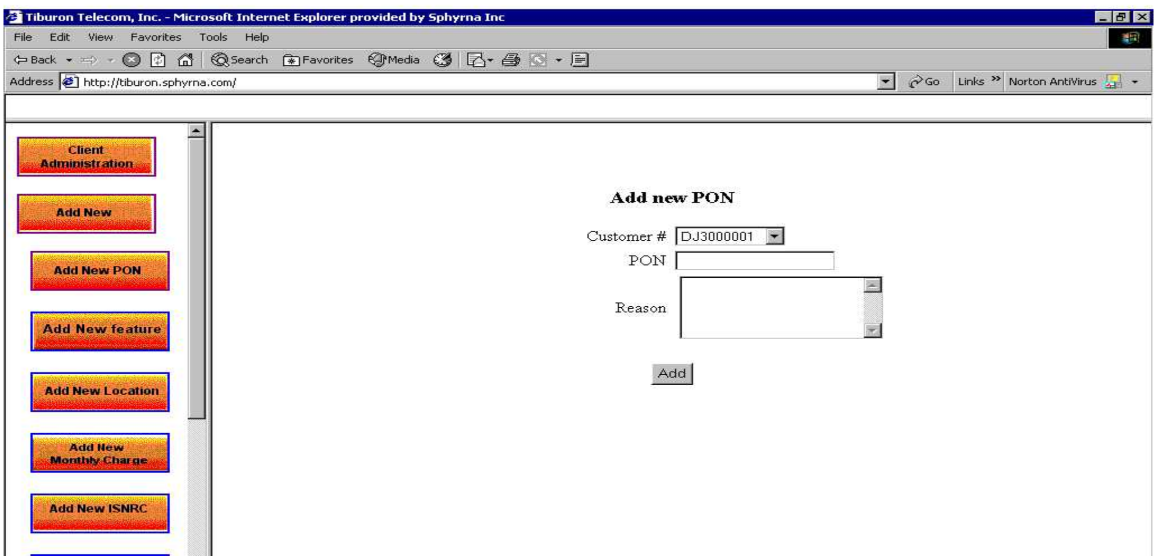
7.1.11 Lock-Unlock

First lookup for a customer by entering few characters of first name, last name, SSN or zip code, DL #, Phone #. Click search. All the customer records matching the entered keywords are displayed. Then to "Lock" a customer, click on the link "Lock". To "Unlock" a customer, click on the link "unlock".

7.2 Application Administration

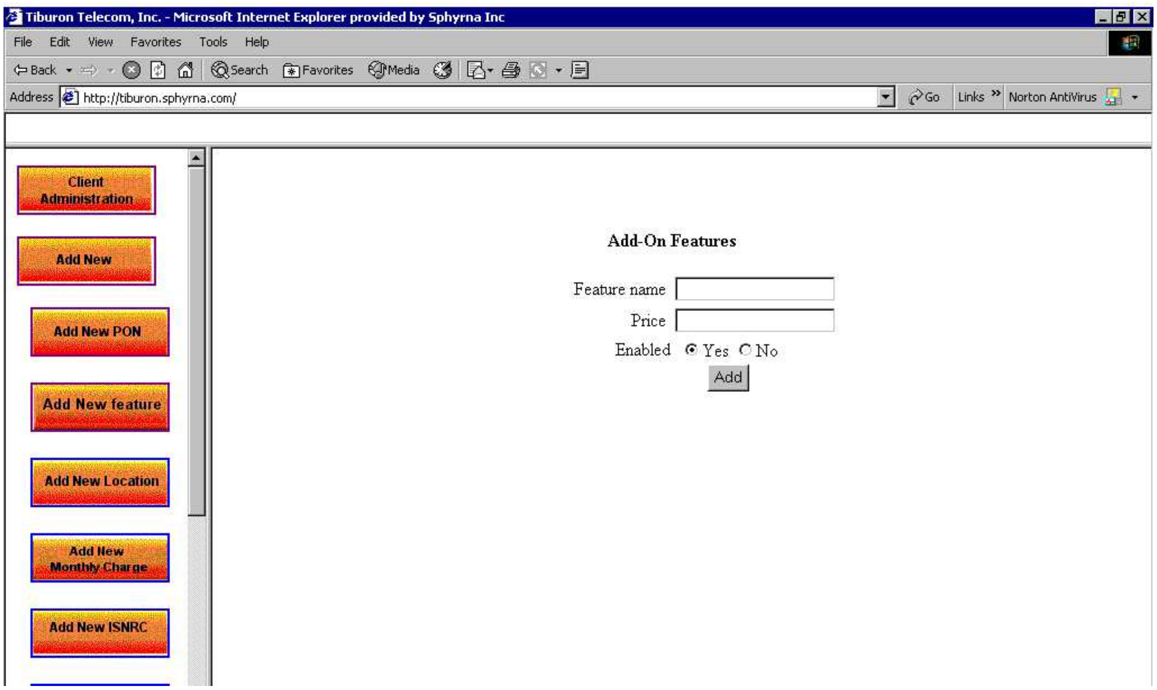
7.2.1 Add New PON (Process Number)

To add a PON to a customer, Select customer #, Type PON #, enter a reason for PON. Click "Add".



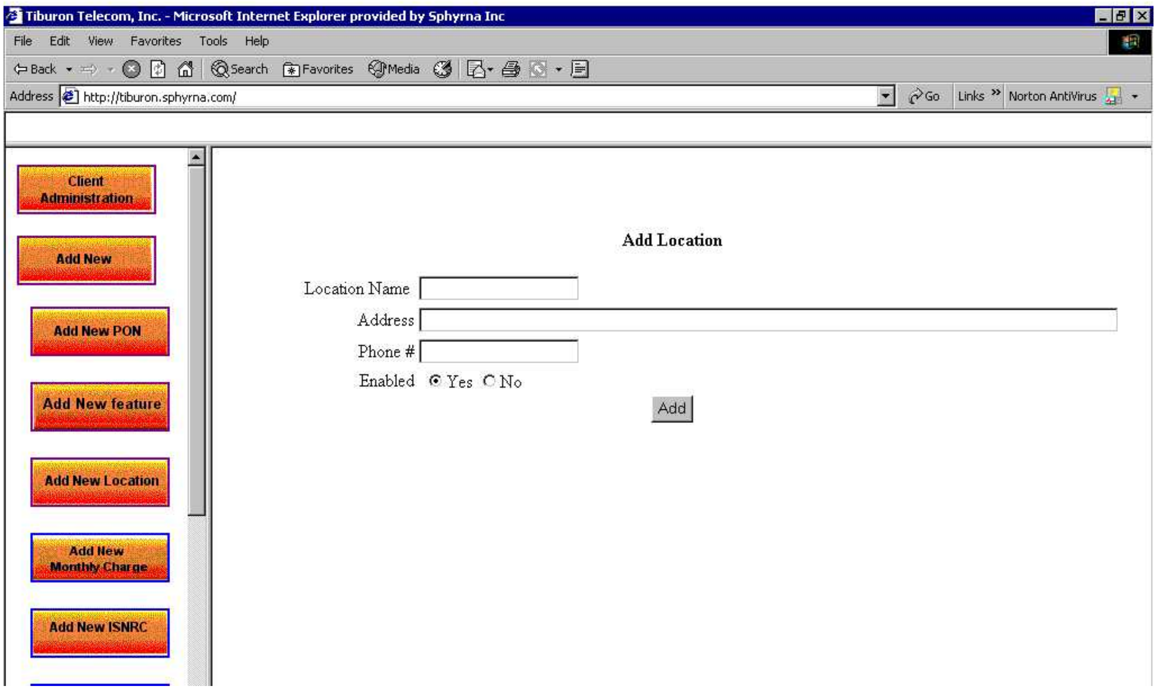
7.2.2 Add New Feature

Click on Add new->Add new Feature. Enter feature name and price for the feature/month. Select “Yes” for enabled to activate the feature.



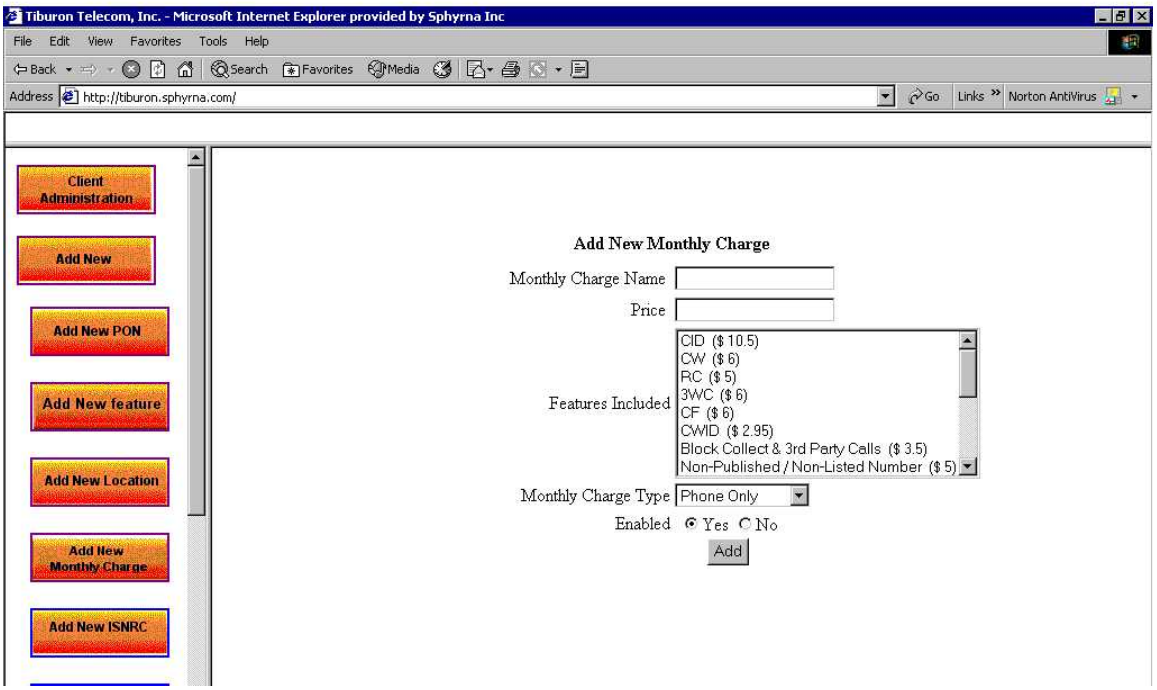
7.2.3 Add New Location

Click on Add New->Add New Location. Enter location name, address of location and phone #. Select "Yes" for enabled to activate the feature.



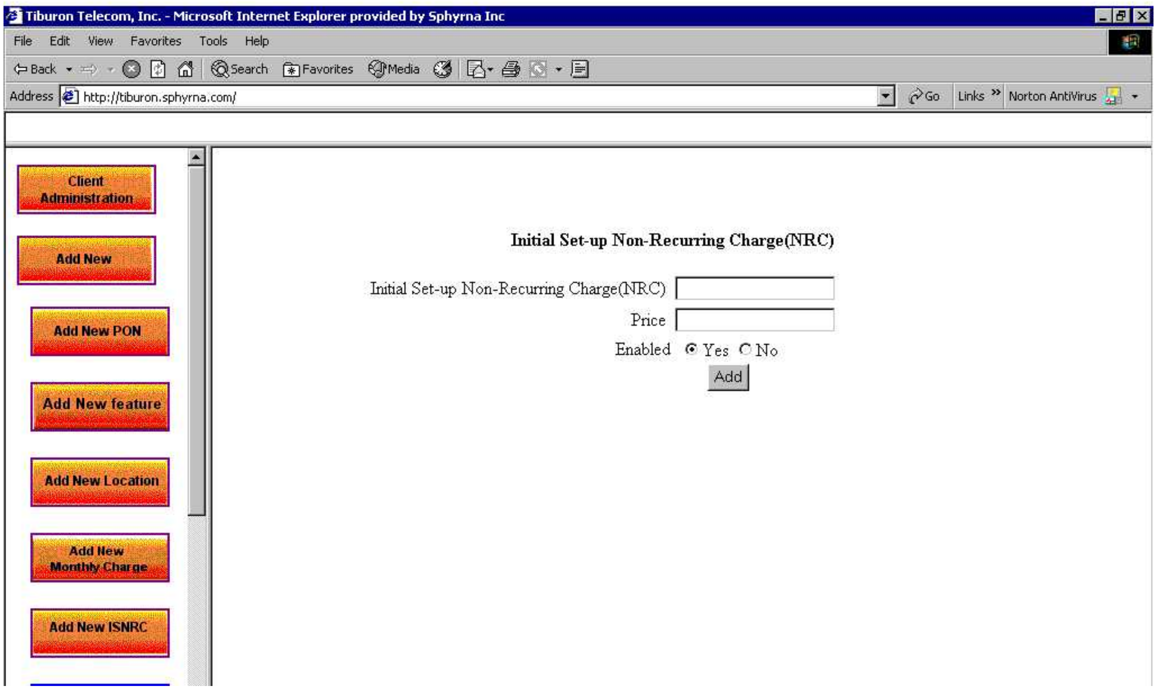
7.2.4 Add New Monthly Charge

Click on Add New->Add New Monthly Charge. Enter monthly charge name, price, features included in the monthly plan and select the monthly plan type. Select "Yes" for enabled to activate the monthly plan.



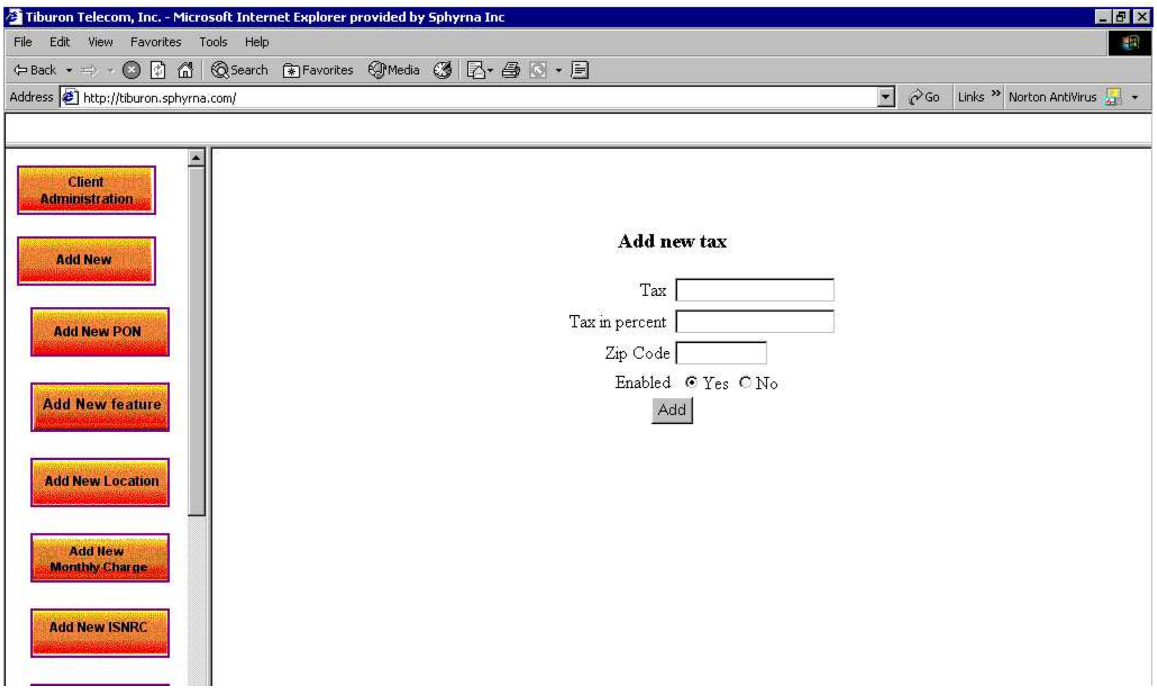
7.2.5 Add New ISNRC

Click on Add New->Add ISNRC. Enter Initial set-up Non recurring charge name and the one time price. Select "Yes" for enabled to activate the ISNRC.



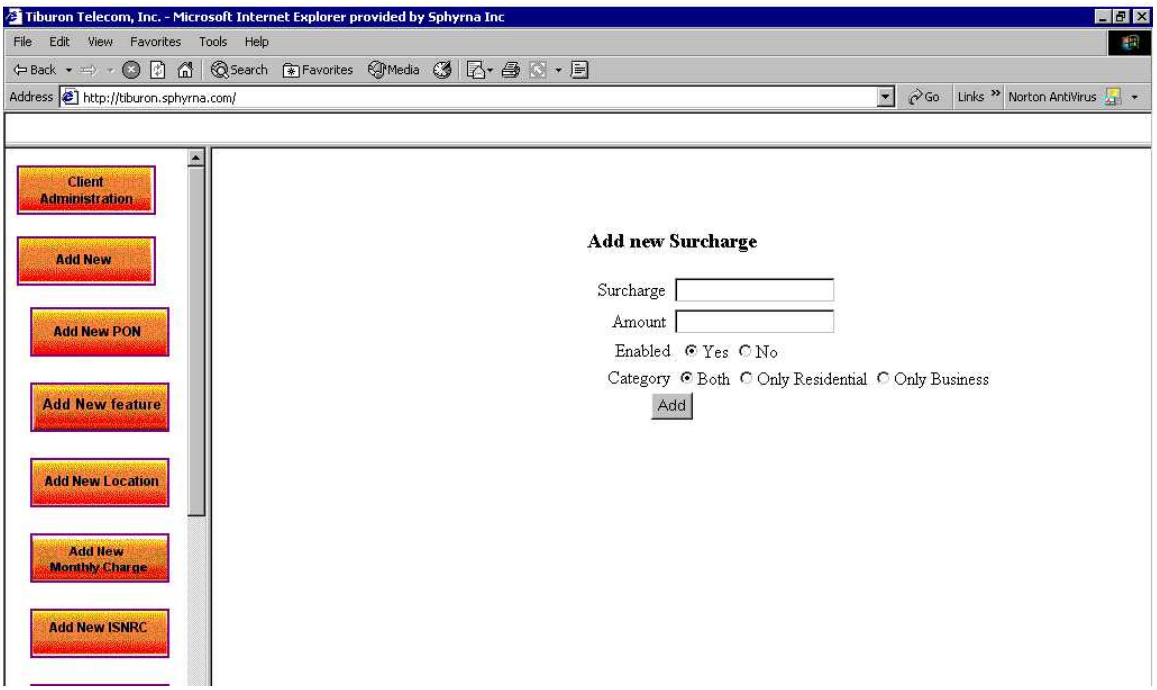
7.2.6 Add New Taxes

Click on Add New->Add New taxes. Enter Tax name, tax in percent and the zip code where the tax is applicable. Select "Yes" for enabled to activate the tax.



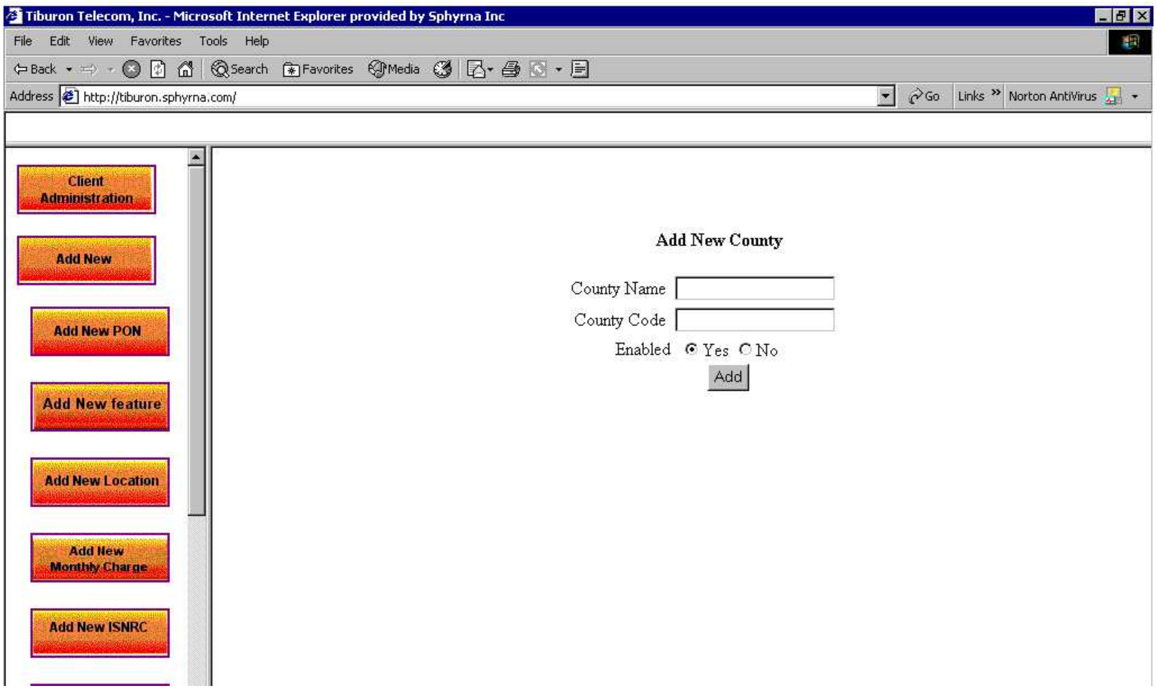
7.2.7 Add New Surcharges

Click on Add New->Add New Surcharges. Enter Surcharge name, surcharge amount and a surcharge category. Select “Yes” for enabled to activate the surcharge.



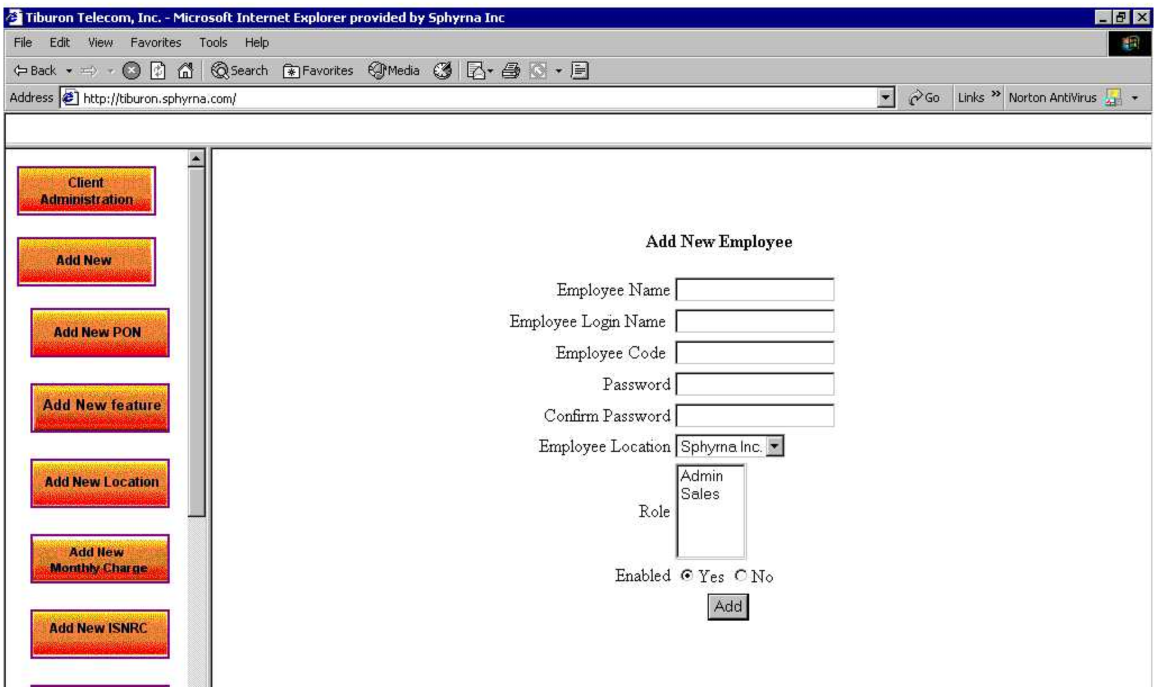
7.2.8 Create New County

Click on Add New->Add New County. Enter County name and County code. Select “Yes” for enabled to activate the surcharge.



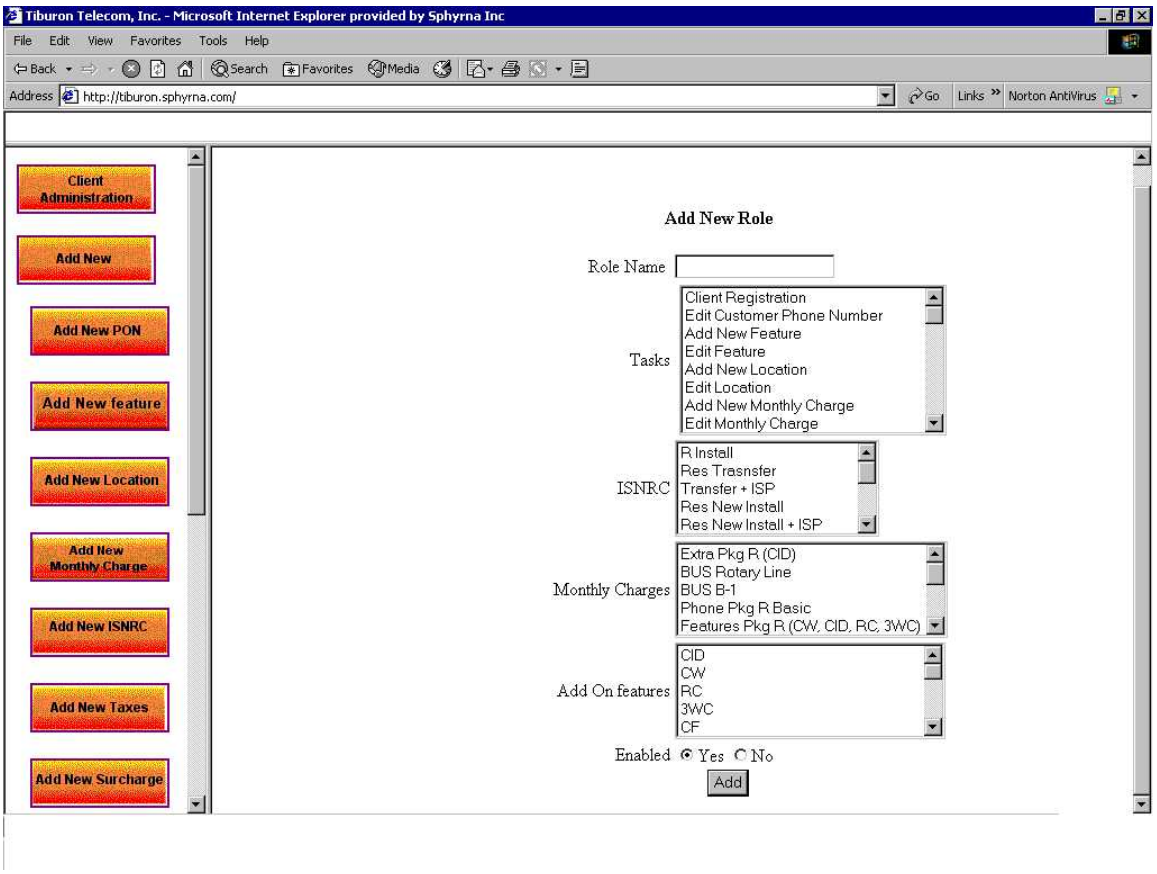
7.2.9 Create New Employee

Click on Add New->Create New Employee. Enter employee name, employee login name, employee code, password, confirm password, employee location and role. Select "Yes" for enabled to activate the employee. Note password and confirm password must match exactly. Passwords are case sensitive.



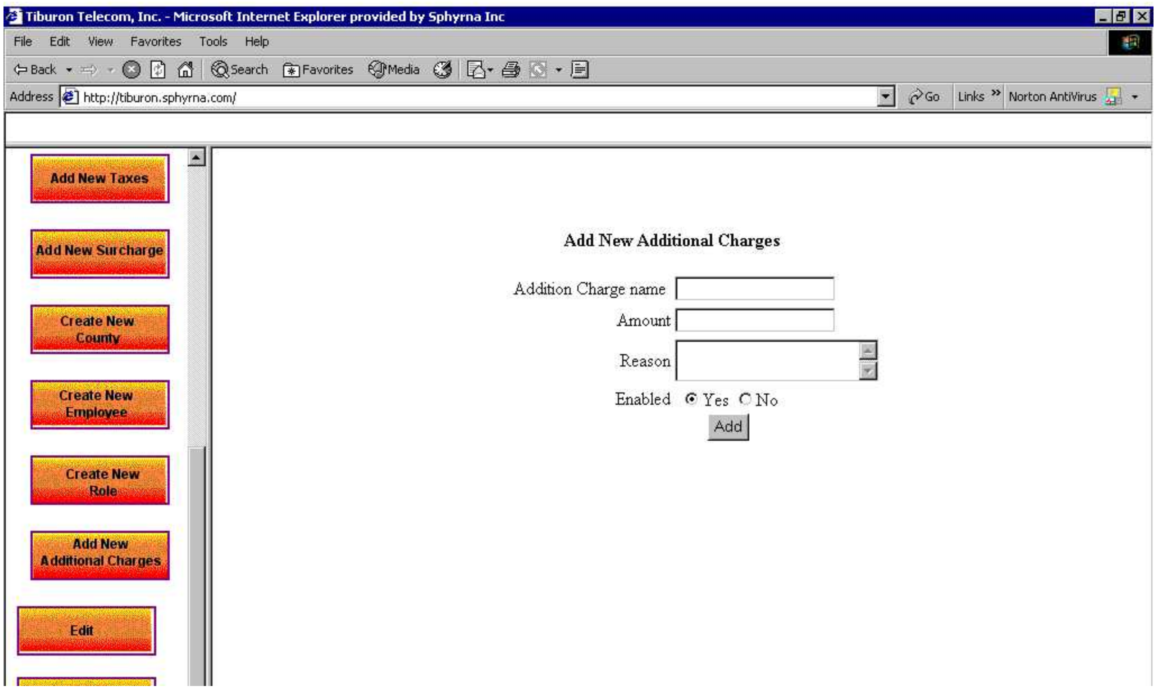
7.2.10 Create New Role

Click on Add New->Create New Role. Enter role name, tasks an employee in the role can perform, ISNRC-the role has access to, monthly charge-the role has access to and the add-on features -the role has access to. Select "Yes" for enabled to activate the role. Click "Add" to add the role.



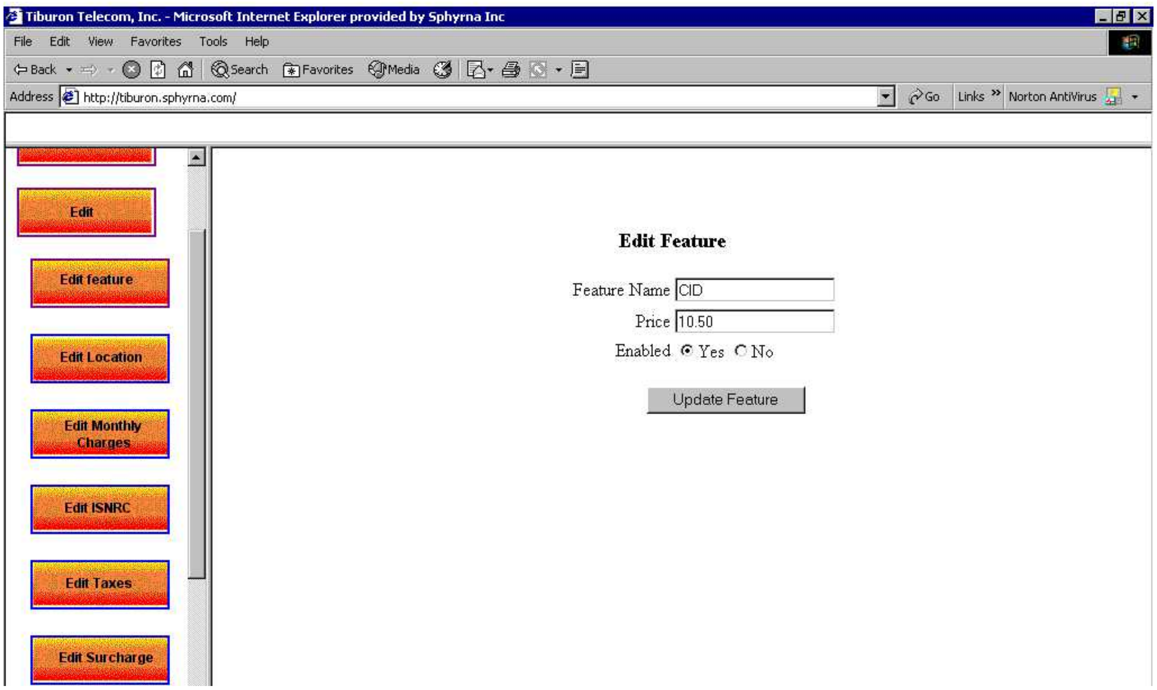
7.2.11 Add New Additional Charges

Click on Add New->Add new additional charges. Enter additional charge name, amount and reason for additional charge. Select "Yes" for enabled to activate the additional charge.



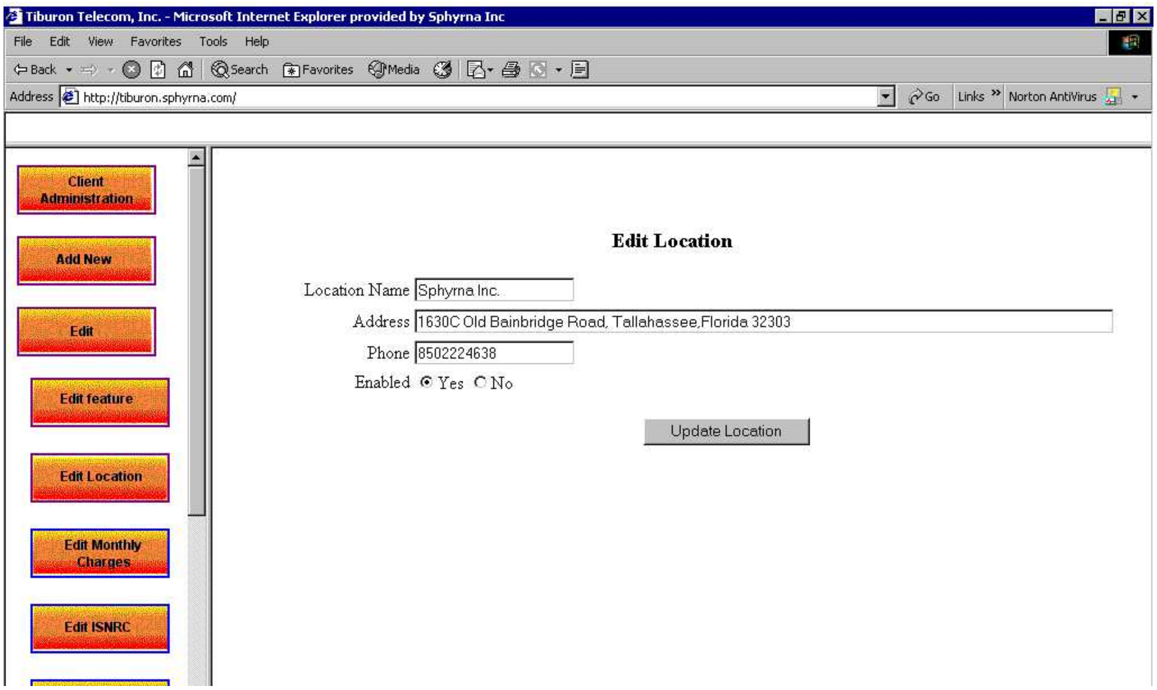
7.2.12 Edit Feature

Click on Edit -> Edit feature. Select the feature that you want to edit and click on Edit feature. Once the changes are made, click on update feature. No blank fields are accepted.



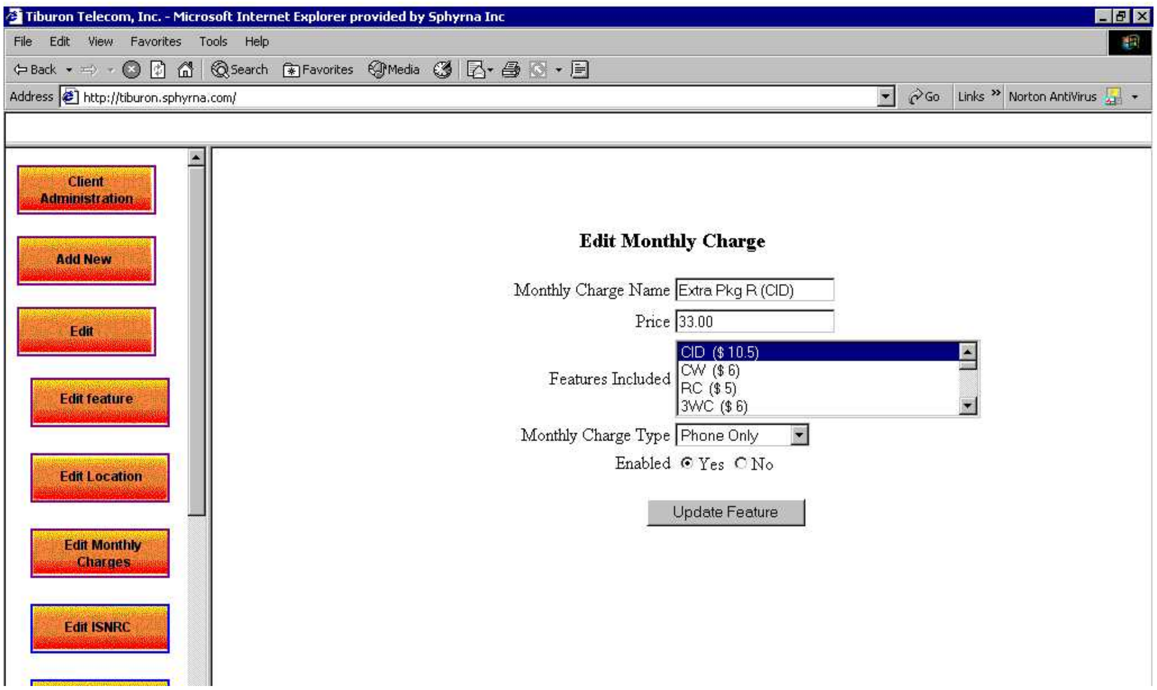
7.2.13 Edit Location

Click on Edit -> Edit Location. Select the location that you want to edit and click on Edit location. Once the changes are made, click on update location. No blank fields are accepted.



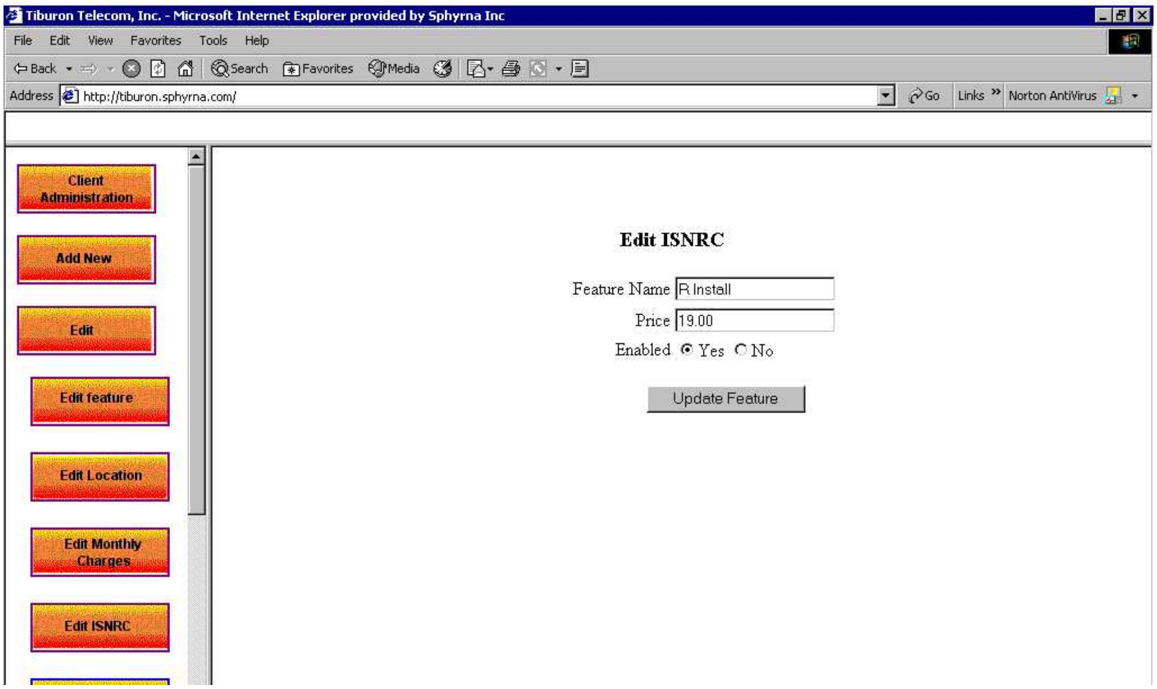
7.2.14 Edit Monthly Charges

Click on Edit -> Edit Monthly charges. Select the monthly charge that you want to edit and click on Edit monthly charge. Once the changes are made, click on update monthly charge. No blank fields are accepted.



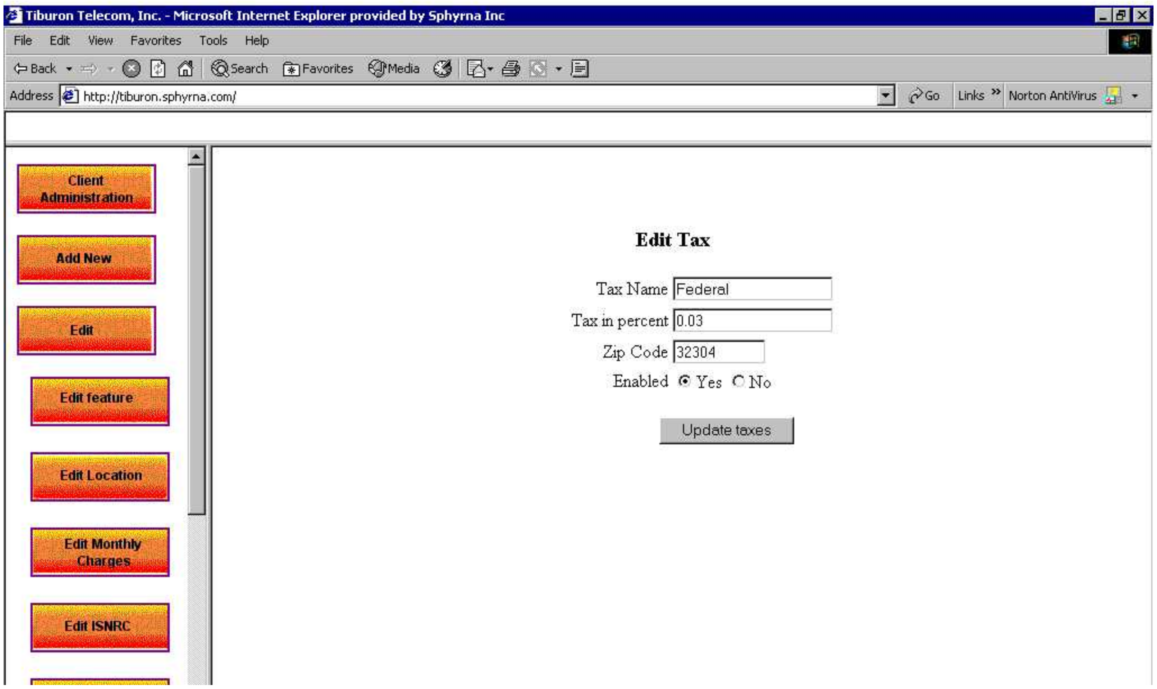
7.2.15 Edit ISNRC

Click on Edit -> Edit ISNRC. Select the ISNRC that you want to edit and click on Edit ISNRC. Once the changes are made, click on update ISNRC. No blank fields are accepted.



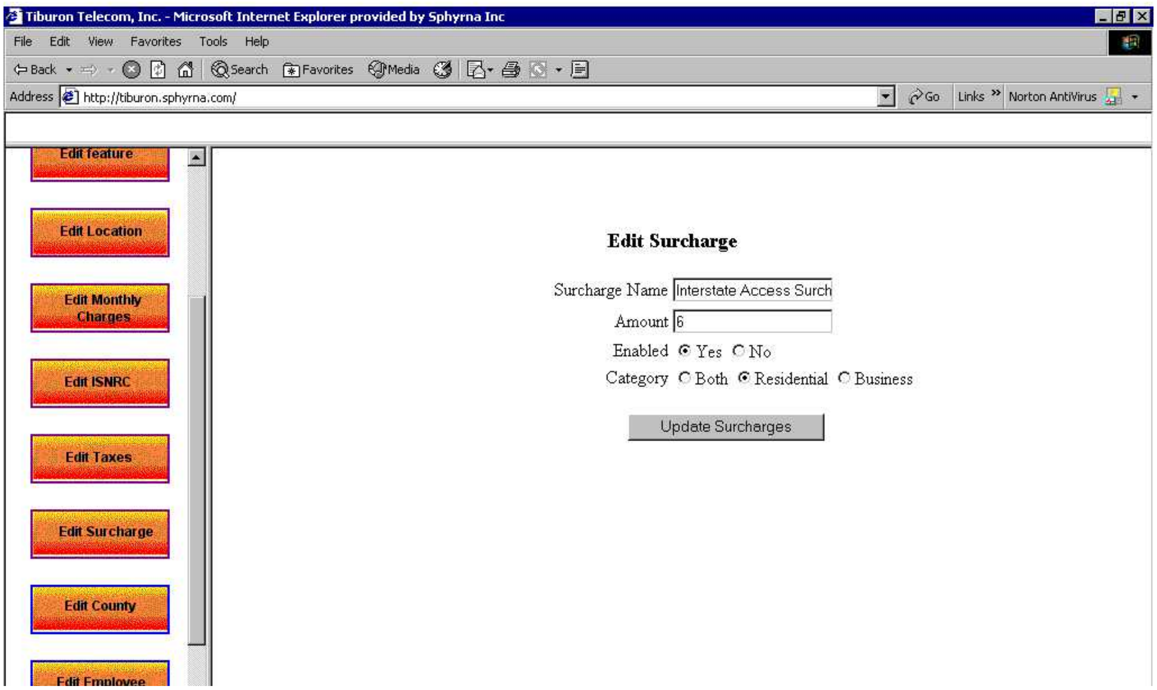
7.2.16 Edit Taxes

Click on Edit -> Edit Taxes. Select the Taxes that you want to edit and click on Edit Taxes. Once the changes are made, click on update Taxes. No blank fields are accepted.



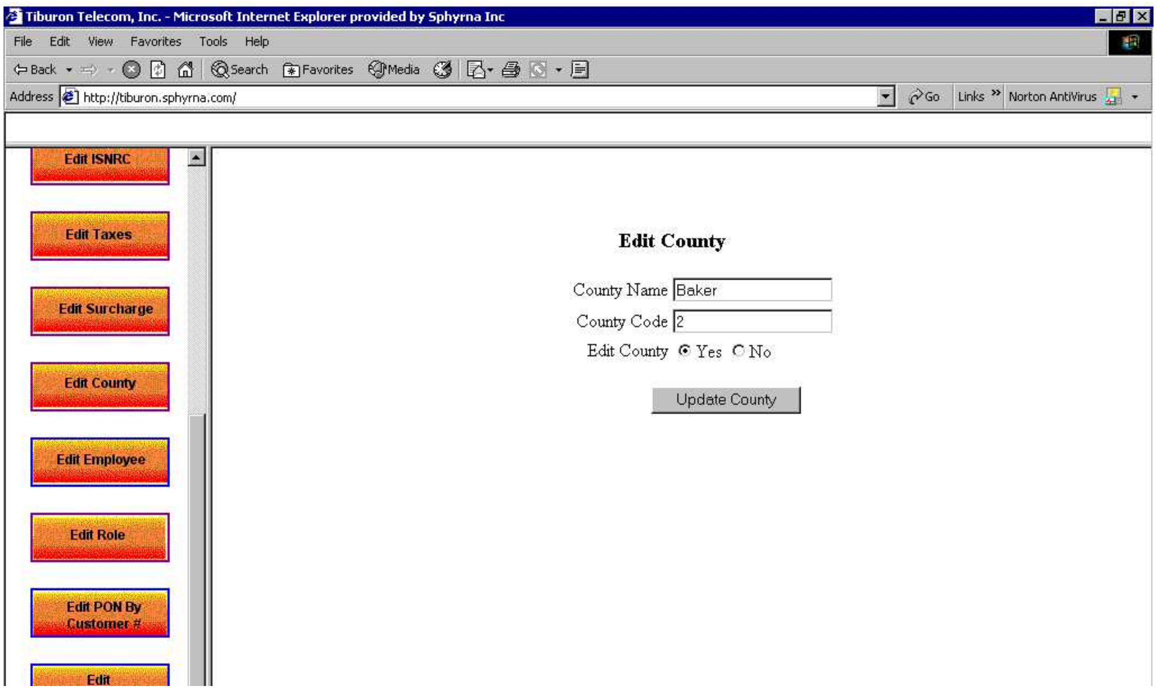
7.2.17 Edit Surcharges

Click on Edit -> Edit Surcharges. Select the surcharge that you want to edit and click on Edit Surcharges. Once the changes are made, click on update surcharge. No blank fields are accepted.



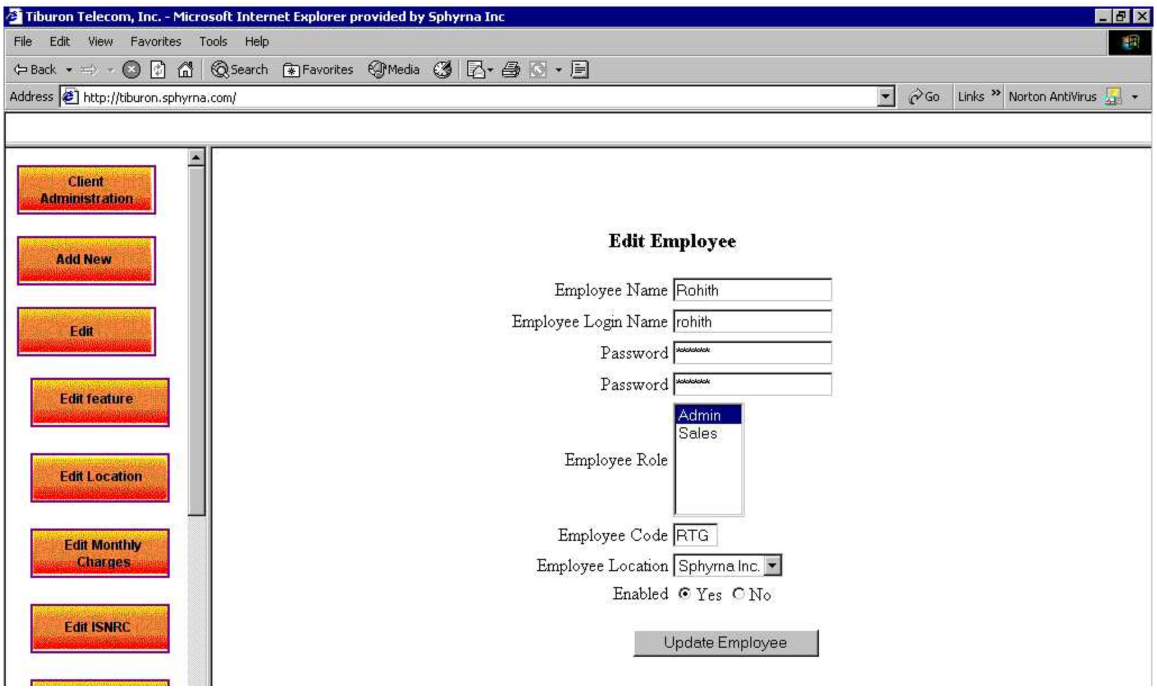
7.2.18 Edit County

Click on Edit -> Edit County. Select the county that you want to edit and click on Edit County. Once the changes are made, click on update County. No blank fields are accepted.



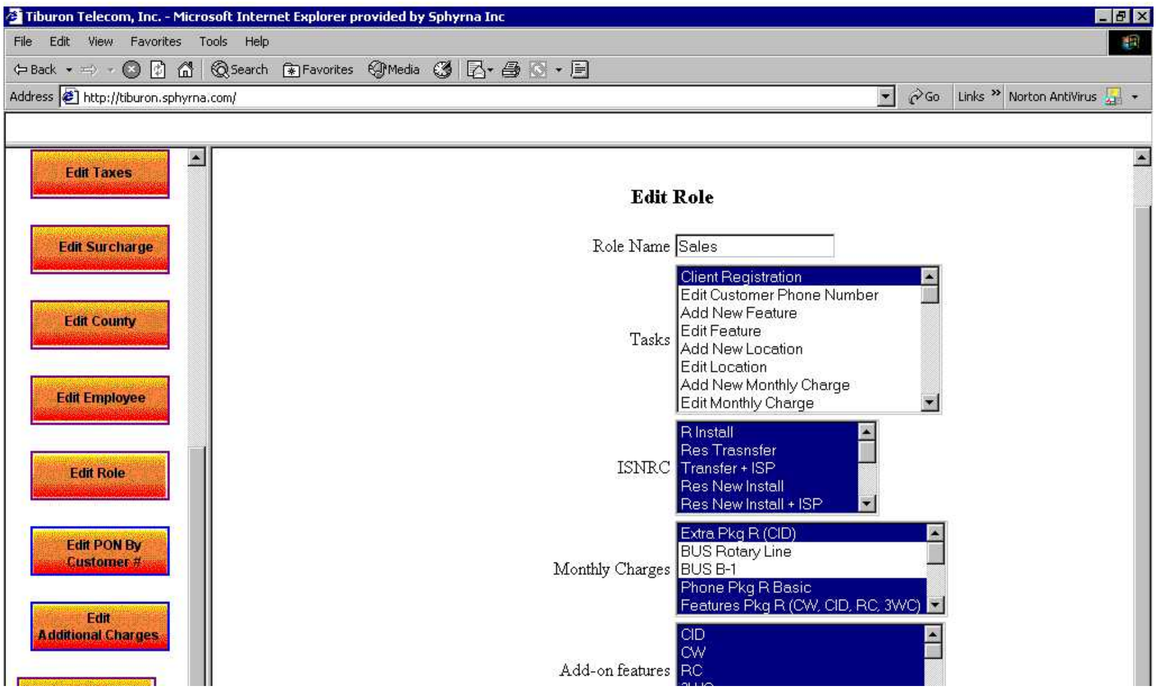
7.2.19 Edit Employee

Click on Edit -> Edit Employee. Select the employee that you want to edit and click on Edit employee. Once the changes are made, click on update employee. No blank fields are accepted.



7.2.20 Edit Role

Click on Edit -> Edit Role. Select the role that you want to edit and click on Edit role. Once the changes are made, click on update role. No blank fields are accepted.

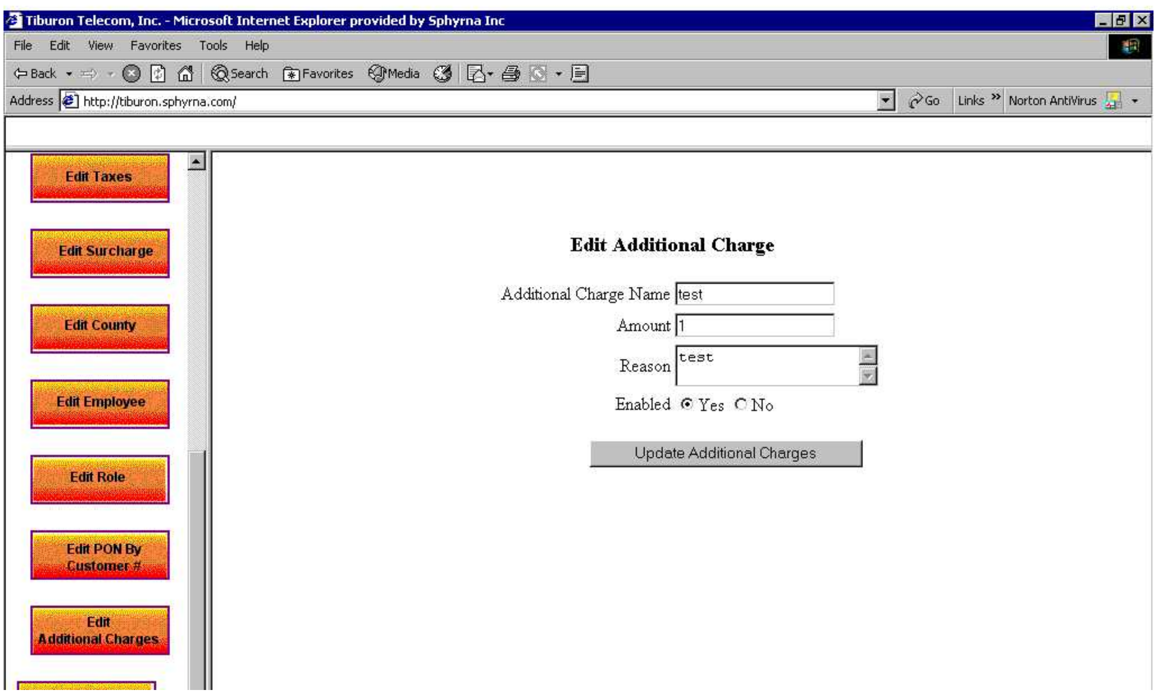


7.2.21 Edit PON by Customer

Click on Edit -> Edit PON by Customer #. Select the Customer, whose PON you want to edit. Click on Edit customer. A list of all the PON associated with the customer is displayed. To edit a particular PON click on edit. Once the changes are made, click on update PON. No blank fields are accepted.

7.2.22 Edit Additional Charges

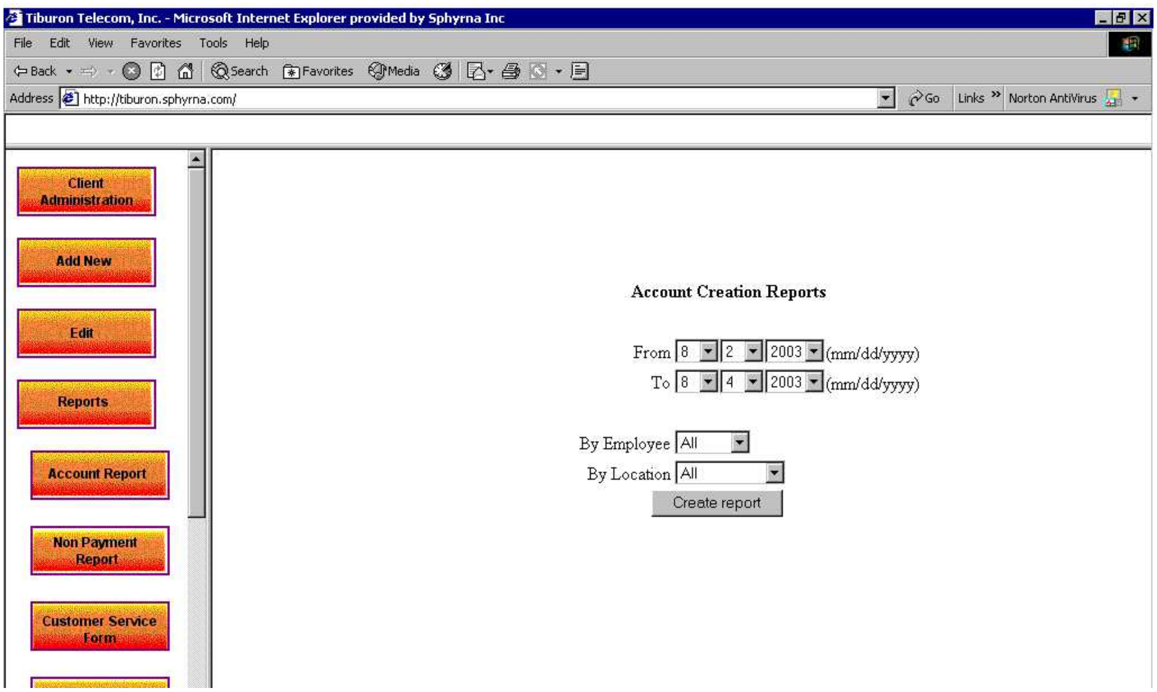
Click on Edit -> Edit Additional charges. Select the additional charges that you want to edit and click on Edit additional charges. Once the changes are made, click on update surcharges. No blank fields are accepted.



7.3 Reports

7.3.1 Account Report

For account creation report, select from date and to date. Choose the employee (responsible for creation of account) and location (account creation location). If "All" is chosen for employee and location, then all accounts created between the chosen dates will be displayed irrespective of location or employee.

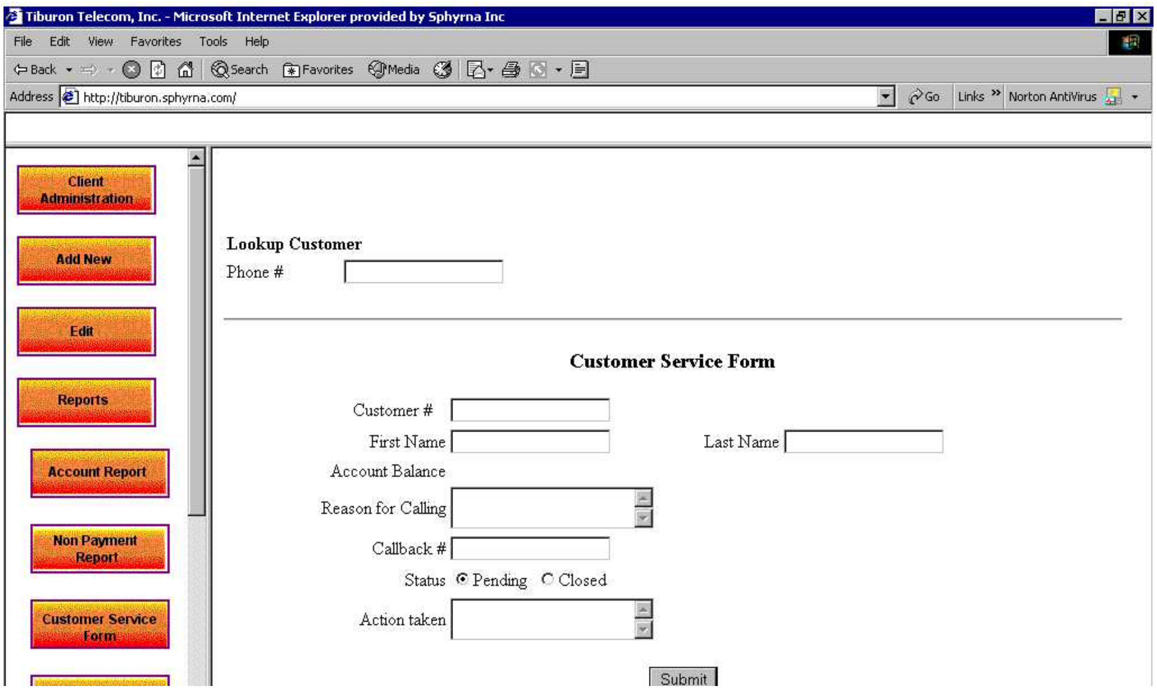


7.3.2 Non Payment Report

Click on Reports->Non Payment Report. This report will display the names of all the customers whose account is due.

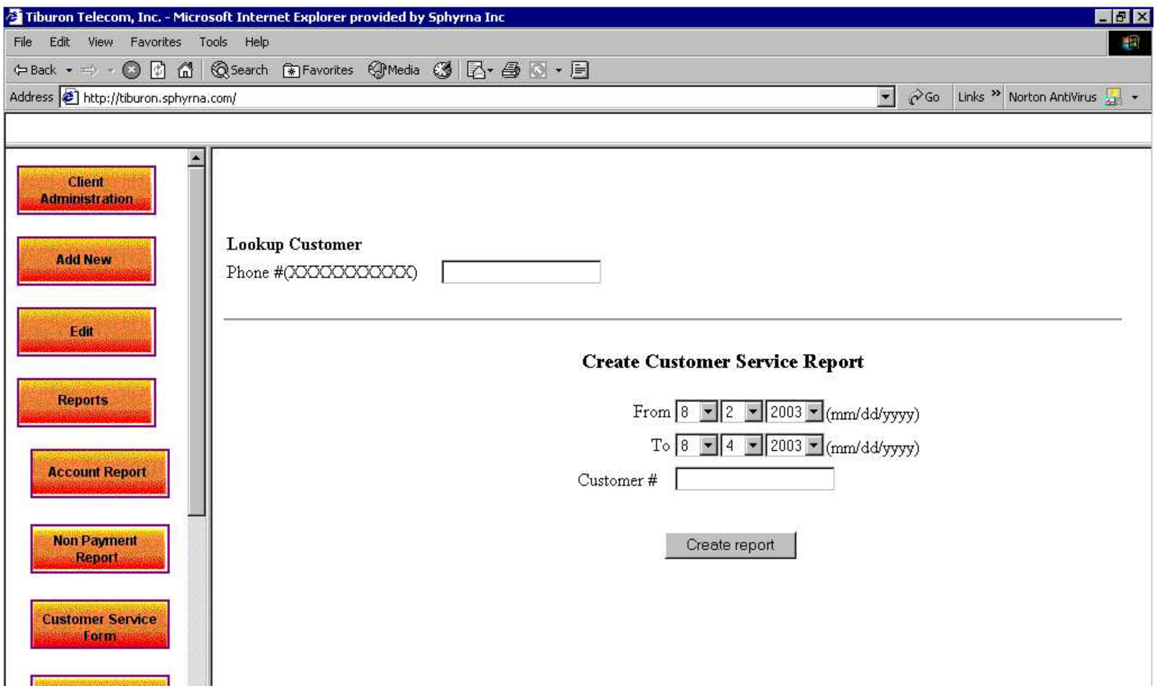
7.3.3 Customer Service Form

Click on Reports->Customer service form. Use the customer's phone # to lookup customer's information. Enter information like reason for calling, callback #, status and action taken. Click submit.



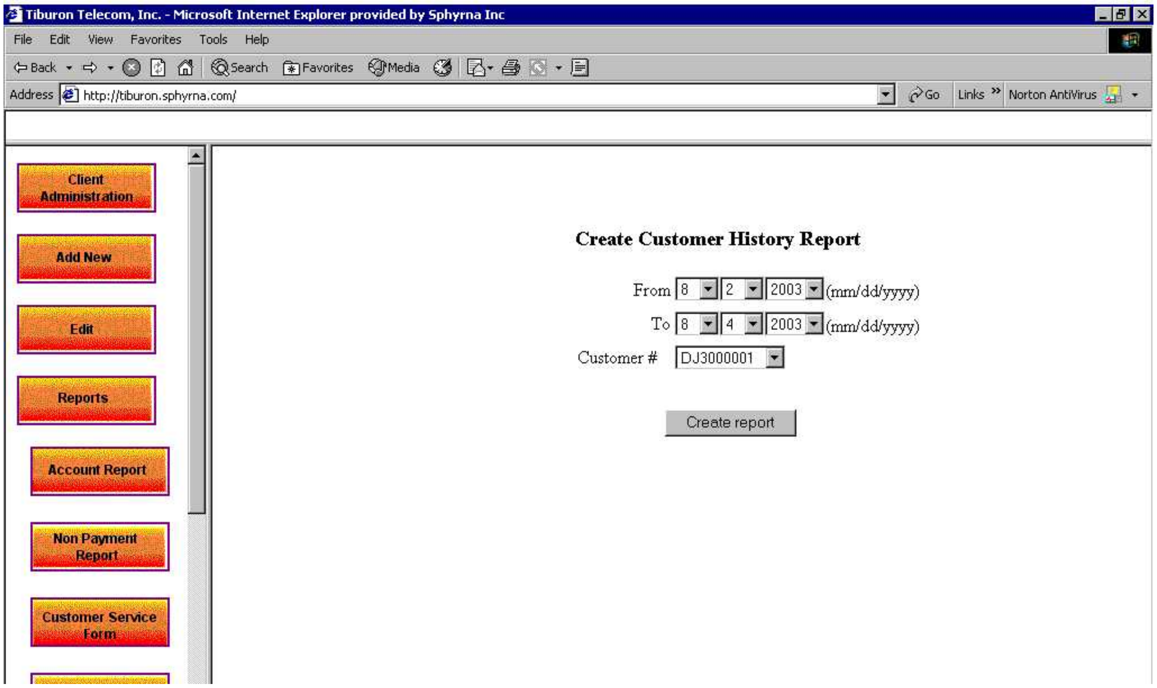
7.3.4 Customer Service History Report

Click on report->Customer service report. Using phone number lookup the customer #. Choose from date and to date. Click “create report”.



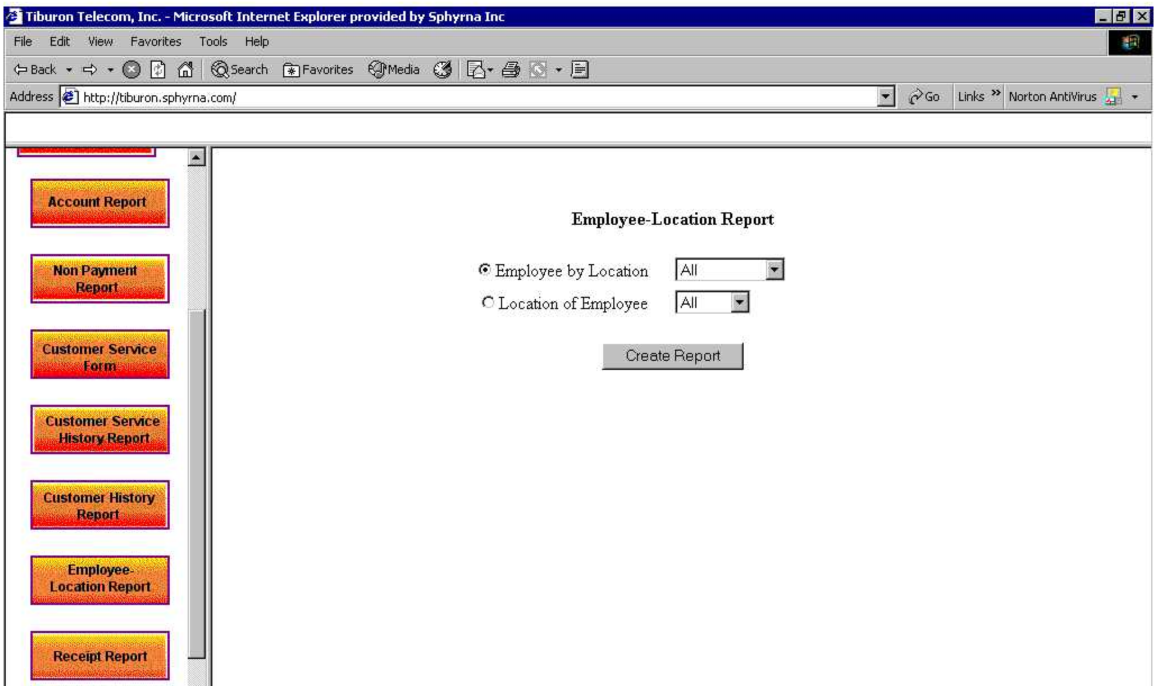
7.3.5 Customer History Report

Click on report->Customer history report. Choose from date and to date. Choose the customer # of the customer whose customer history report has to be pulled up. Click “create report”.



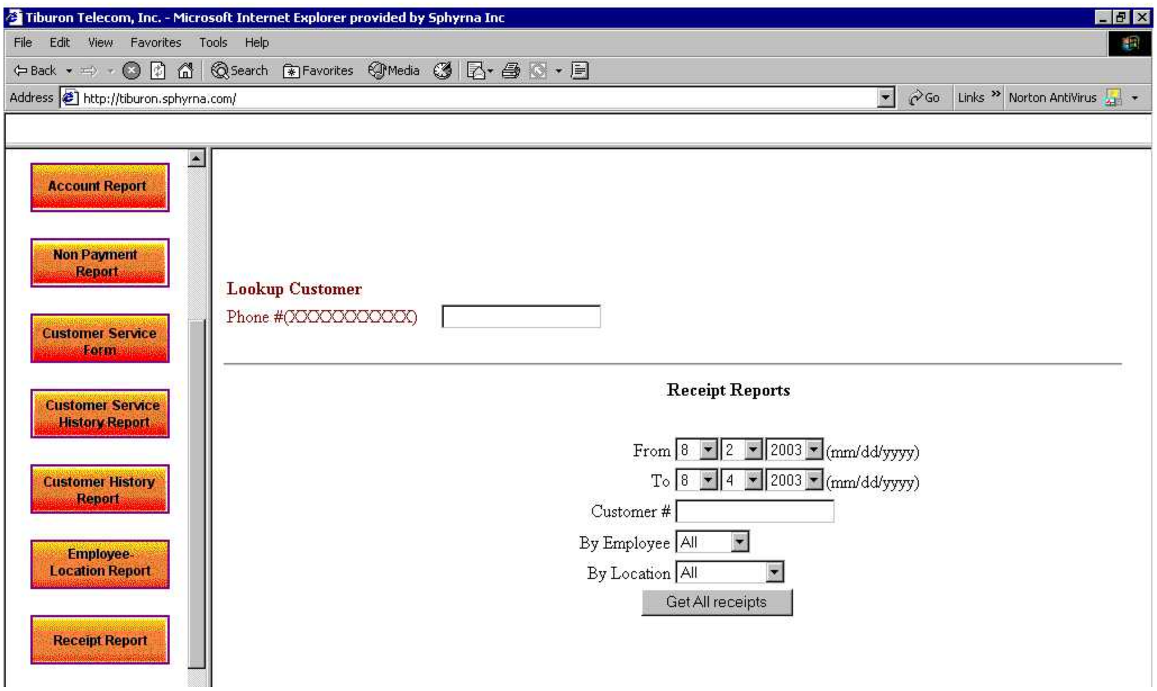
7.3.6 Employee-Location Report

Click on report->Employee-Location Report. Choose an employee and location whose information is required and click create report. If, "All" is chosen for employee and location, then employees at all locations will be displayed.



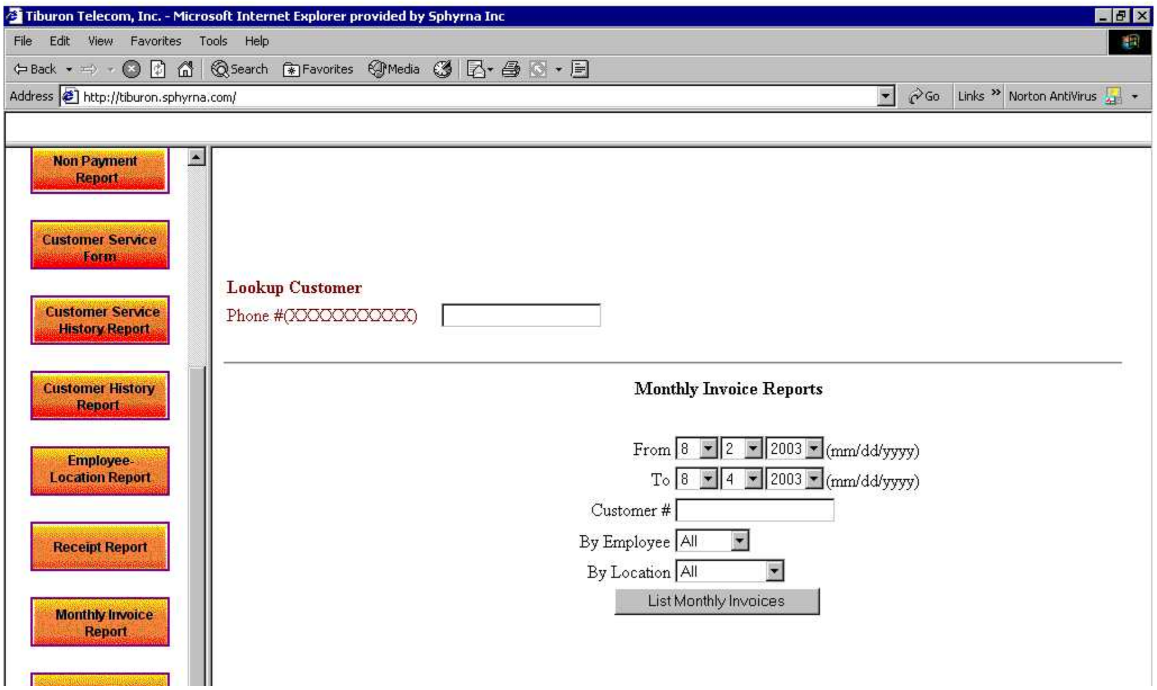
7.3.7 Receipt Report

Click on Report->Receipt Reports. Choose from date and to date. Using customer lookup get the customer # of the customer whose receipt report is to be pulled up. Choose an employee and location. If, "All" is chosen for employee and location, then all receipts of that customer will be displayed.



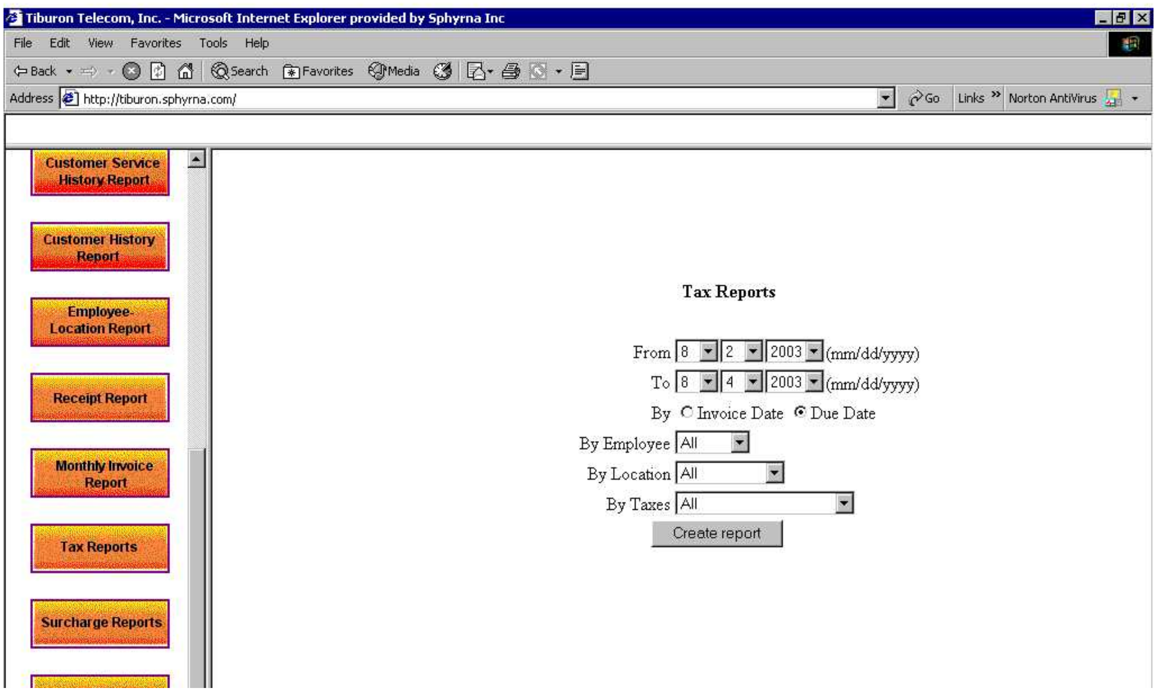
7.3.8 Monthly Invoice Report

Click on Report->Monthly Invoice Reports. Choose from date and to date. Using customer lookup get the customer # of the customer whose monthly invoice report is to be pulled up. Choose an employee and location. If, "All" is chosen for employee and location, then all monthly invoice of that customer will be displayed.



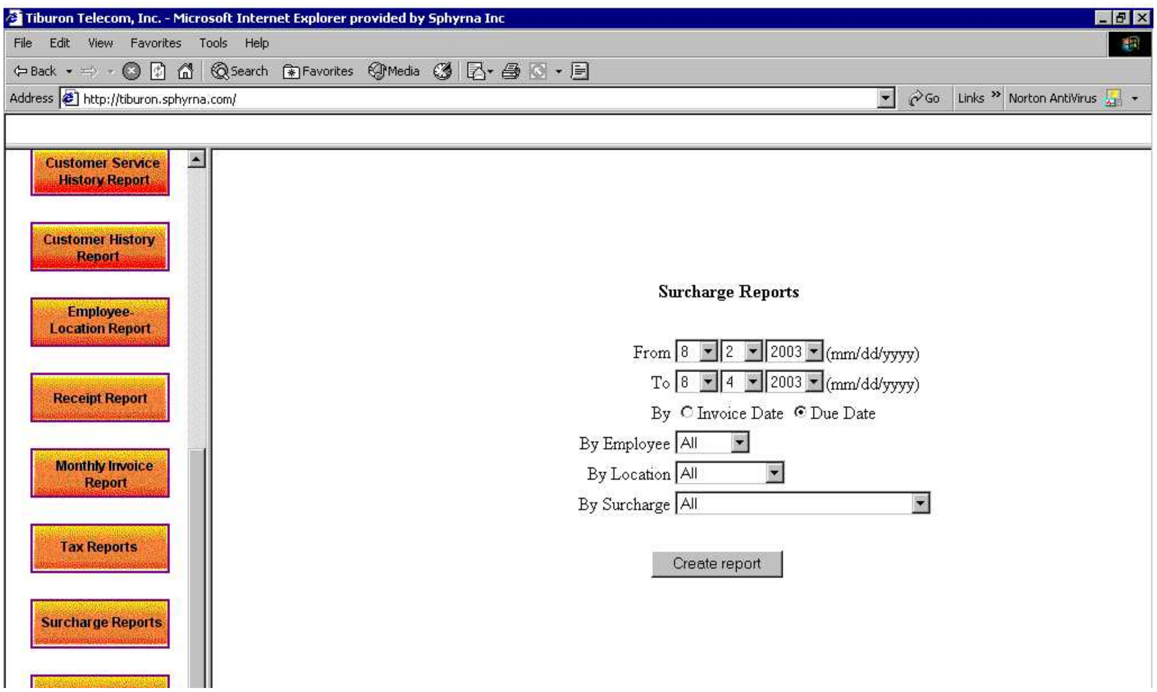
7.3.9 Tax Reports

Click on Reports->Tax Reports. Choose from date and to date. Now the above chosen dates could be sorted by Invoice date or Due date. Choose an employee, location and the tax type. If, “All” is chosen for employee, location and taxes, then all taxes received between the chosen dates will be displayed and the total will be the sum of them.



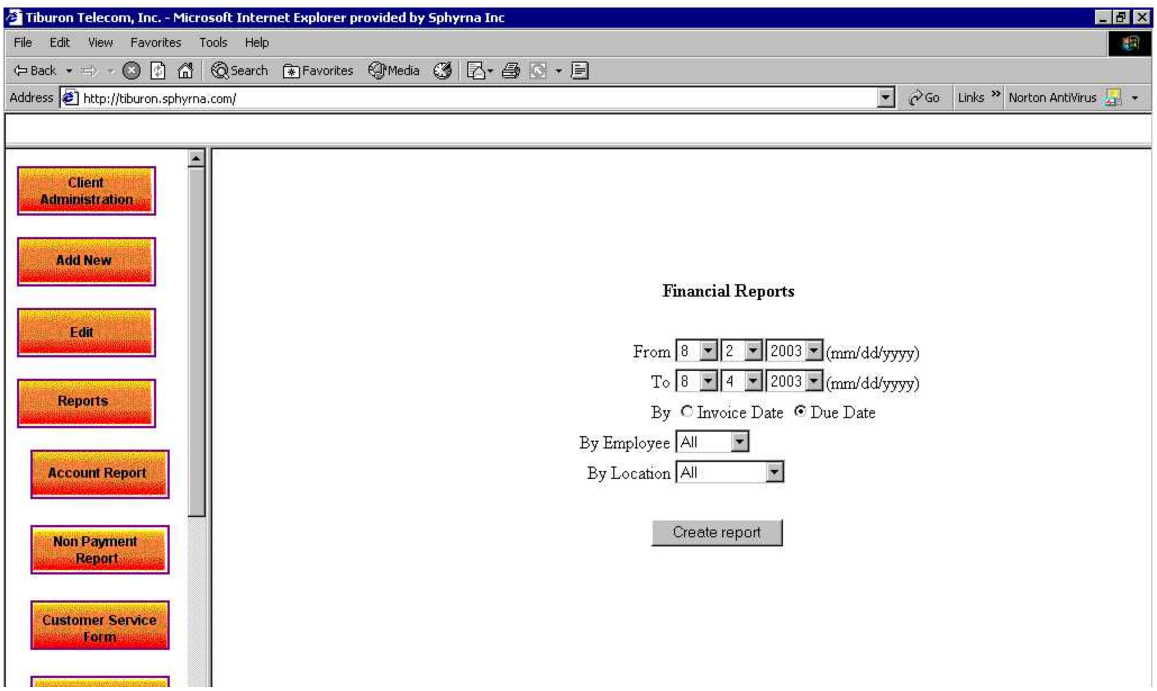
7.3.10 Surcharge Reports

Click on Reports->Surcharge Reports. Choose from date and to date. Now the above chosen dates could be sorted by Invoice date or Due date. Choose an employee, location and the surcharge type. If, “All” is chosen for employee, location and surcharges, then all taxes received between the chosen dates will be displayed and the total will be the sum of them.



7.3.11 Financial Reports

Click on Reports->Financial Reports. Choose from date and to date. Now the above chosen dates could be sorted by Invoice date or Due date. Choose an employee and location. If, "All" is chosen for employee and location, then all financial transactions between the chosen dates will be taken into account.



8. Security

Securing Web sites is a critical, complex issue for Web developers. A secure system requires careful planning, and Web site administrators and programmers must have a clear understanding of the options for securing their site.

ASP works in concert with the Microsoft Framework and IIS to provide Web application security. ASP provides built-in functionality to make it easy to perform authentication, authorization, and impersonation, where required.

This application uses MD5 encryption algorithm to protect critical data. Important customer information is stored encrypted in the database. It provides a basic authentication. Basic authentication involves a browser-generated dialog for user authentication. The password transmitted between client and server is always encrypted. This application is also session dependent. If the application is left unused for more than fifteen minutes, then the user is logged out automatically. To log back in user has to open a new browser and go through the basic authentication process again.

9. Future Plans

This project is a working project. Since the nature of billing system changes often, it becomes necessary from the developer point of view to keep up with change. When the document was being written, the billing system was being tested to run on a cluster, for continuity and reliability.

In future, one can easily foresee that most of the phone companies will also be an ISP. So this billing software, which is currently designed for a phone company, would be in future accommodate Internet customers in the same billing package.

From the security point of view, research has been planned to look for better and more secure encryption system. Providing secure access to the webserver is also on the cards.

Reference

[1] JavaScript Bible, 4th Edition, by Danny Goodman, Hungry Minds, 2001

[2] **http://www.mysql.com**

[3] **http://msdn.microsoft.com/library/default.asp?url=/library/en-us/iisref/htm/ref_vbom_.asp**

[4] Writing Secure Code by Michael Howard and David LeBlanc

[5] Active Server® Pages Bible by Eric Smith