



SmartBilling– A Billing Solution for Hosted IP Contact Centre (HIPCC) service providers

Marketing White-paper

Version 1.0

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List of Acronyms

- ASN – Abstract Syntax Notation
- CDR – Call Detail Record
- CSV – Comma Separated Values
- FTP – File Transfer Protocol
- GUI – Graphical User Interface
- HCC – Hosted Call Center
- HIPCC – Hosted Internet Protocol Contact (or Call) Centre
- PDF – Portable Document Format
- ROI – Return on Investment
- XML – eXtensible Markup Language

Table of contents

INTRODUCTION	5
Overview of the Solution	5
Operating Cycle.....	5
Platforms	7
ARCHITECTURE OF THE SMARTBILLING SYSTEM	7
Diagram	7
Architecture Overview	7
Architecture Overview	8
Mediation Manager	8
Rating Manager	8
Billing Manager.....	9
Monitor	9
FEATURES AND BENEFITS.....	10
Distinct functional modes	10
Key functionalities	10
Flexibility.....	10
Configurable Rate Plans	11
User Interface.....	12
Technology	12
Database	12
Client.....	12
Server.....	13
BENEFITS	13
Business enabler	13
Flexible business plans	13
Data availability	13
ROI	14
SYSTEM REQUIREMENTS	14
MARKET ANALYSIS.....	14
FUTURE PROSPECTS	15
Multi-format CDR support	15
Multi-utility CDR.....	15
Web-based Front End	15
Dynamic rate plans.....	15
Processing speed.....	15
REFERENCE DOCUMENTS.....	15
CONTACT INFORMATION	16

Introduction

Advancements in the field of telecom and related services has forced telcos and other service providers to face rapid change and technological advancements, due to which the demands from the customers – both internal and external have changed and increased. Telcos and service providers must have the right infra and solutions in place to not only face these waves of change but also launch new services, which exploit these advancements.

One such new business model is provisioning of hosted call center solutions. The Smart Billing Solution is a business-critical application, which forms the backbone for any service provider who specializes in this. It is all the more imperative for providers who typically need to handle close to around 2 million calls in a given day and with a vast array of varying rate-plans. In the current scenario, there does not exist any other billing solution that is flexible enough to be customized as well as scaled up to handle high call volumes. The customization can be applied to extremely flexible rate-plans, usage-plans. All the billing information is generated with extreme accuracy and speed.

Overview of the Solution

SmartBilling as already introduced is an application which enables companies who are providing hosted call center services to generate bills / invoices for the customers who are using such services. The criticality of this application can be imagined from 2 simple factors –

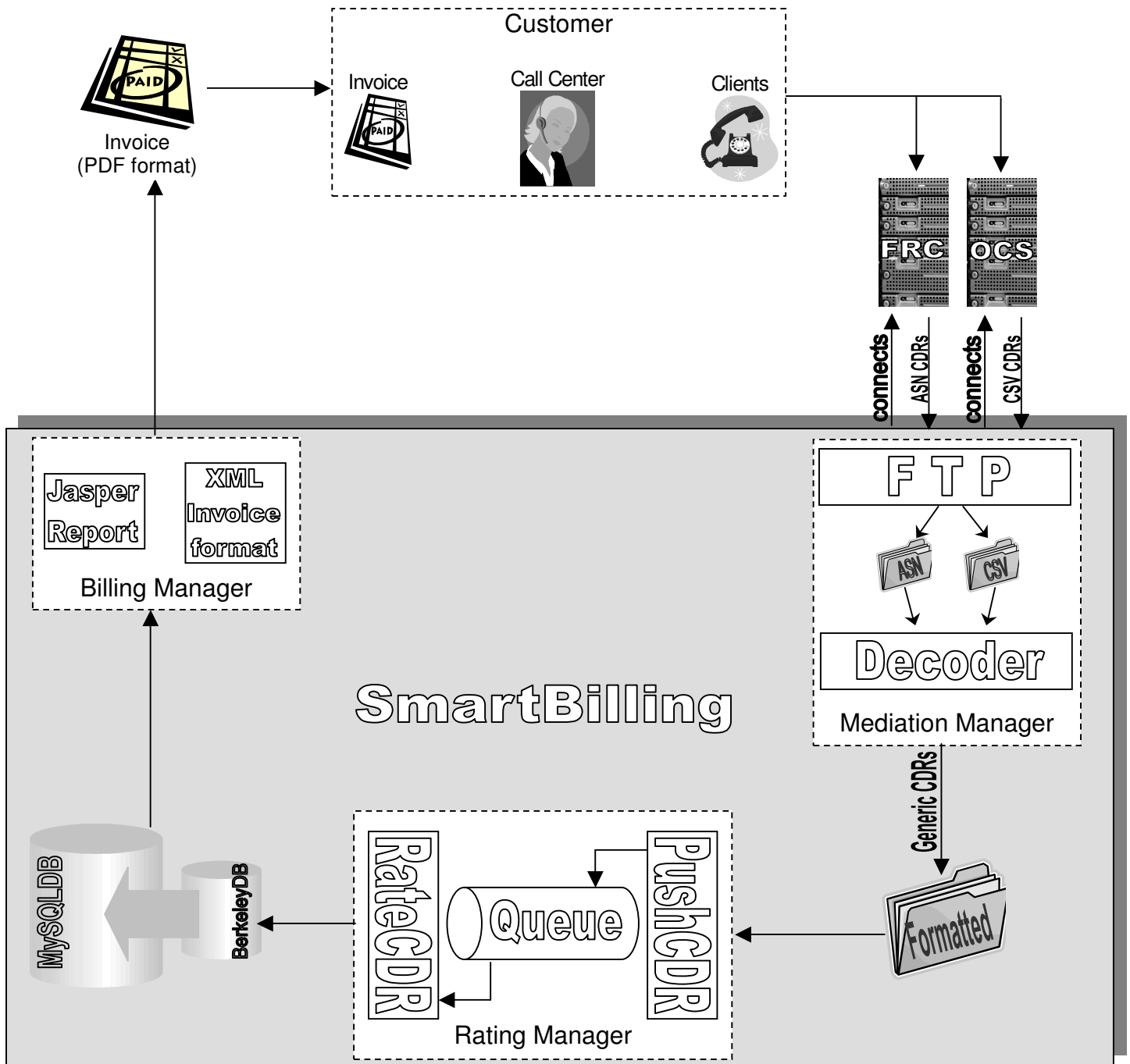
- Flexibility – these are international calls and are being made at any time on any day, hence appropriate intelligence must be present with the billing software to take care of varying time zones, varying dates or holidays, varying distances, varying types of calls being made. These aspects will alter the rating plans being applied to each of the individual calls being made.
- Speed – in excess of a couple of million calls being made per day, makes accurate ratings for the individual calls all the more complex.

The Software performs the fundamental task of mapping a Customer to a single or multiple Subscriptions, where a customer is a company using / accessing some number of ports from the HCC service provider and subscription is an integration of the product and price information. Once this mapping is done, every call made by the customer will be billed in accordance to the subscription.

Operating Cycle

If we look into the operating cycle of the Smart Billing solution, the entire billing activity, leading to the generation of the invoice, are performed by 3 major components, and they are:

- Mediation Manager
- Rating Manager
- Billing Manager.



In the above-depicted operating cycle of the SmartBilling system, the major components of the SmartBilling system (enclosed within the shaded box) have been laid out.

As is evident the process flows from the Customer making the calls and the CDRs being generated by the FRC / OCS servers. The Mediation Manager which fetches the CDRs from the FRC/OCS servers and converts the incoming CDRs into a generic format. Then the Rating manager fetches the decoded CDRs, applies the appropriate rating plans and stores the resulting data into MySQL databases (data is replicated into MySQL from the cache db implemented through BerkeleyDB). The Billing Manager is responsible for

integrating all the related data from the DBs and preparing the invoice using Jasper reports. The invoice (in PDF format) is sent to the customer and the cycle ends.

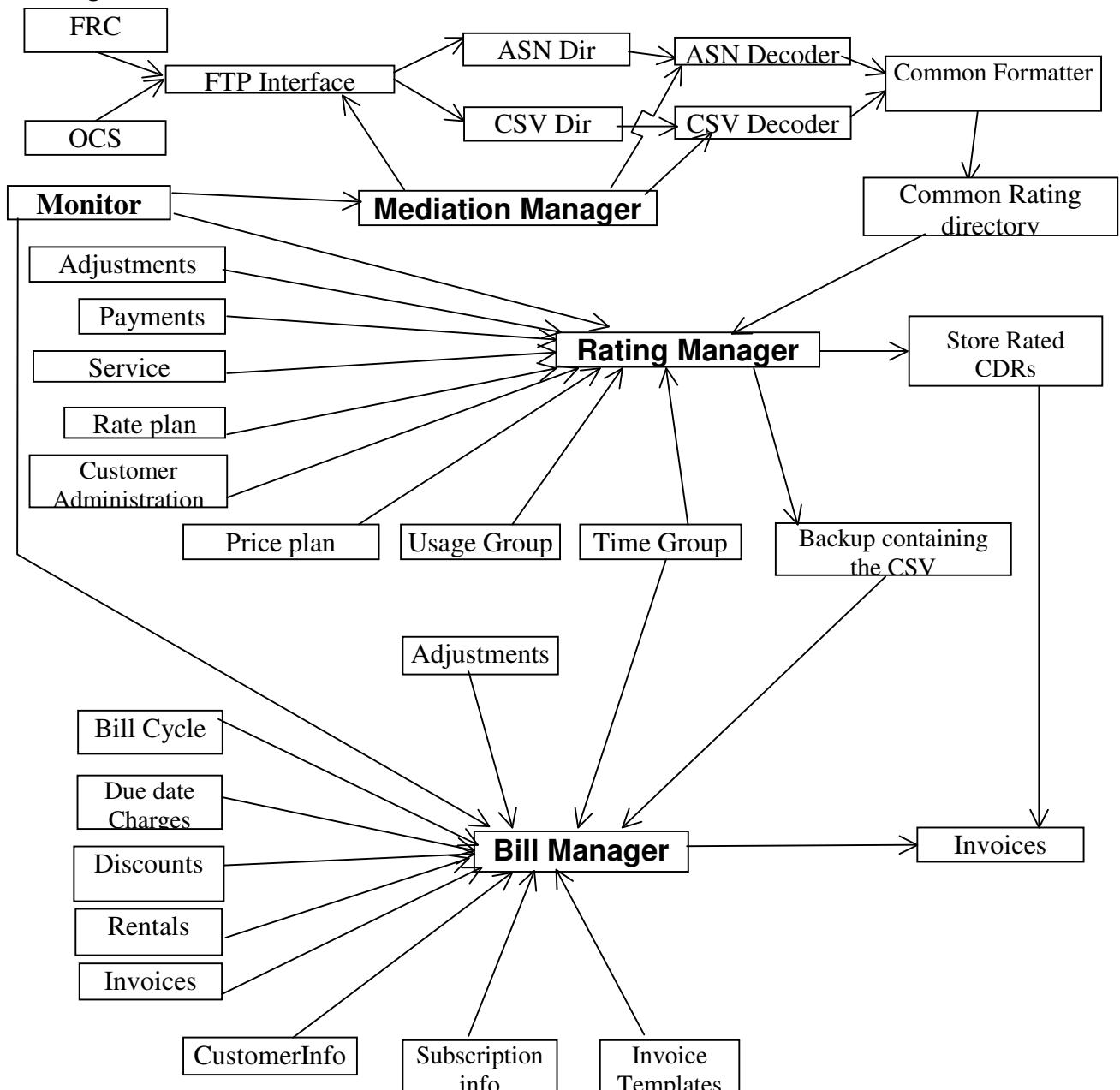
Platforms

The SmartBilling server needs a dual-processor based Intel Xeon system with 4GB of RAM. The OS needs to be RedHat Linux 10 Enterprise Edition. Some other specific requirements that are needed are BerkeleyDB 3.2.21 and MySQL Cluster 5.1. The report generator is Jasper Reports 2.0. The Web server being used is Tomcat Server 5.0

The GUI of the SmartBilling system works on any OS with Java.

Architecture of the SmartBilling System

Diagram



Architecture Overview

The components along with their functionalities are explained below –

Mediation Manager

The Mediation Manager is responsible for transferring the CDRs from the remote machine to the local machine and decode it into the generic CSV format.

The two components in the Mediation manager are the FTP Interface and the other one is the Decoder. When the `startInterface` request comes from the Monitor, it creates a new thread for the FTP interface. Its main job is to transfer the CDRs from the host machine – O.C.S or F.R.C to the local machine. An ASN formatted CDR file will be transferred to the ASN repository directory and the CSV file will go into the CSV directory.

Now when the `'startDecoder'` request comes in the mediation manager starts a decoder thread. The main work of the decoder is to decode the CDRs and put the decoded CDRs in a particular directory. The Decoder initializes with the values from the xml attributes. Now it extracts the CDRs from the source directory one by one and tries to decode all the CDRs according to the format of the file, which could be CSV or ASN. Depending on the format, it first reads the content of the files field by field. Then it puts all the values from each field in a generic sequence into a CSV file. The resulting decoded CDR file is stored in a directory named as `'formatted'`. Similarly CDRs that cannot be converted are stored in a `'rejected'` directory.

This decoding will stop only when the mediation manager gets a client request to stop the decoder i.e. `'stopdecoder'`.

The Mediation Manager has in-built intelligence to reject any request to start a thread that is already running. Moreover all such requests to start FTP Interface or Decoder are stored in its database. Hence if the mediation manager is stopped due to any reason, then during the next execution it will first search for those xml requests that are pending and start those first. This is the overall work of the mediation manager.

Rating Manager

The Rating manager manages the rating procedures. The decoded CDRs generated by the Mediation Manager are processed and the billable units of each call are calculated based upon the rating charges applicable to the subscription of the customer.

There are 3 components for the Rating Manager. The PushCdr, the Queue and the third one is the RateCdr. All three are activated by client requests. The client request contains an xml string, which is parsed by the rating manager and it contains attributes like `"operation type"`, `"operation name"`, `"source directory"`, `"queue name"`, etc.

Based upon the value of the operation type it starts or stops the corresponding thread. If the operation type is `'addQueue'` then it will invoke the queue thread with the parsed parameters. The Pushcdr inserts the CDR record into the queue and the Ratecdr deletes the records from the queue and rates it. Evidently without the queue, the ratecdr or

pushcdr cannot be started. A queue will be running till the rating manager stops based upon a client request or if any ratecdr or pushcdr threads are not using the queue.

When the rating manager receives the 'addPushThread' it creates a PushCDR thread with the parsed parameters. This pushcdr is assigned to a queue and now it opens the each CSV formatted file from the source directory and inserts each CSV record into the assigned queue. This is done as long as there are files in the source directory.

There is an attribute in the xml called 'sleepTime'. When the pushcdr does not get any CSV file in the source directory, it goes to sleep for the duration specified in the attribute, which is mentioned in milliseconds.

With the 'addRateThread' request the rating manager starts a RateCDR by passing all the arguments to it. The RateCdr also is assigned to a queue and collects all the rate-plan details required from the database. Then from the assigned queue the ratecdr retrieves the CSV records and starts rating them according to the rating plans. Using the field values of the CSV record, it rates each record and stores the rated detail into the database. CDRs might be rejected if specified fields do not contain any data. These rejected CDRs will be rated later after getting the proper data. This will continue till the Rating manager stops the RateCDR.

Here it needs to be mentioned that if the useCache setting is 'true', then the data is stored in BerkeleyDB and after a fixed interval the cached data is taken into MySQLDB. This is done to speed up the storage process.

Billing Manager

The Bill Manager controls the billing and invoice generation activities. The Bill Manager starts as a daemon process and waits for the client request.

The Bill Manager finds all the customers for a given billing cycle and prepares the invoice at the end of the billing cycle. It takes into account different components of charging, namely – usage charges (the actual call or data charges), rental charges, invoice charges, adjustments, etc, from the Rental System, Payment and Invoice, Customer Administration and Billing system and then generates the invoice at the end of the bill cycle. It also computes the necessary taxes as applicable.

The Bill Manager uses Jasper Report to prepare and store the invoice in PDF. The invoice format is configurable and is stored in an xml file (*.jrxml).

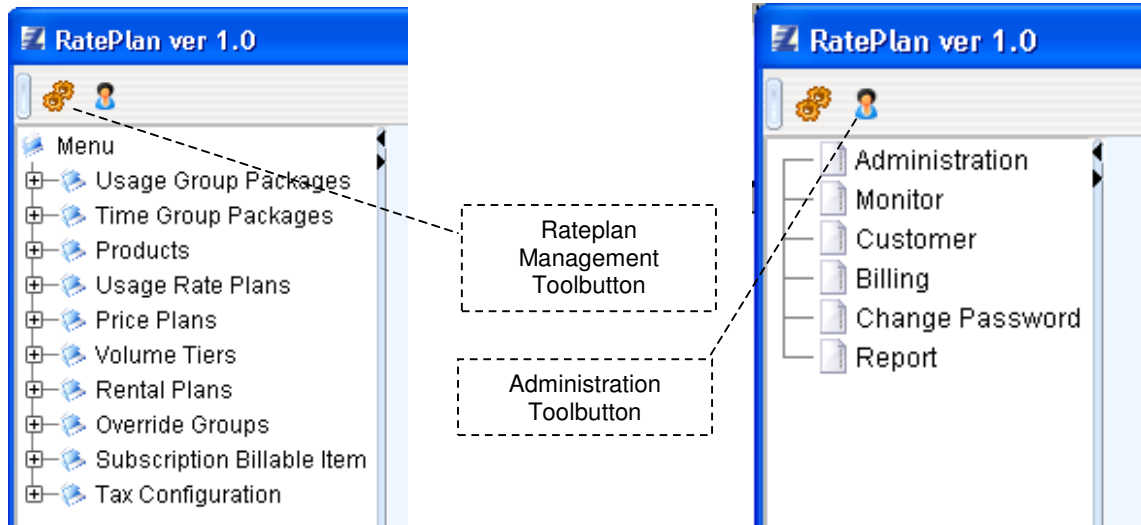
Monitor

The Monitor process controls all the three managers. The user through a GUI can access the Monitor. Using the front-end the required processes can be started / stopped and also their status can be checked.

Features and benefits

Distinct functional modes

The SmartBilling System is divided into 2 distinct functional modes, namely – the Rateplan Management and the Administration mode. This enables a clear segregation of activities and makes the system more logically arranged and easy to use.



As is evident the Rateplan menu provides the functionalities to manage the Products, Price plans, Pulse rates (volume tiers), Rentals, Taxes, Distance settings and Date/Time settings.

The Administration module provides the functionalities essentially for starting the 3 different Managers (corresponding processes and threads), Customer management, Subscription management, Billing management, Reporting and the usual user administration activities.

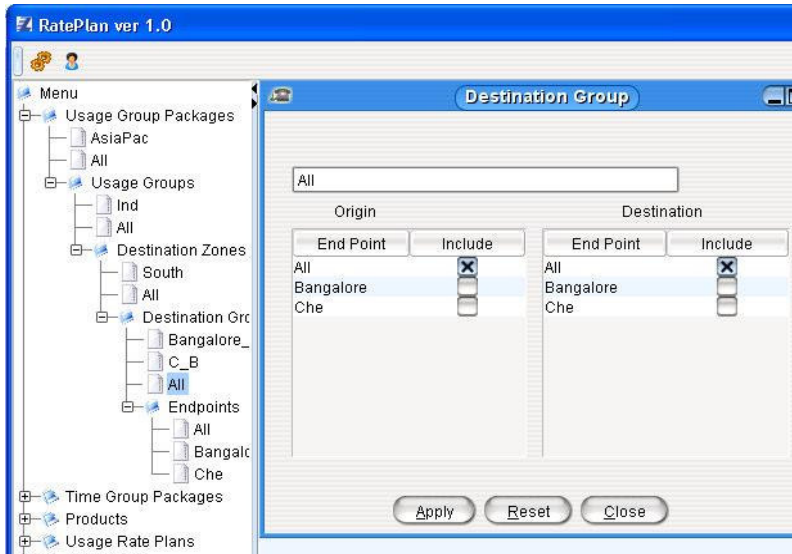
Key functionalities

The system is equipped with distinct and logically progressive modules for all the major functional areas like managing Customer, Subscription, Rate-plan, Distance zones, Pulse rates, Time & date, Rentals, all of which are key constituents which decide the billable amounts for each call being made by the customer through the HCC service provider.

Flexibility

The system is flexible in terms of highly configurable call billing factors. The factors that affect billing of every individual call could be as varied as distances, specific days, time of call, pulse rates or any override instructions that might be made applicable to a particular customer based on which the calls will be billed. Couple this flexibility with the volume of calls that need to be billed over a given period and we will have fair idea of the capabilities of the SmartBilling system.

With the help of some crucial screenshots we can have a clearer understanding of the flexibility that is provided for call billing configurations.

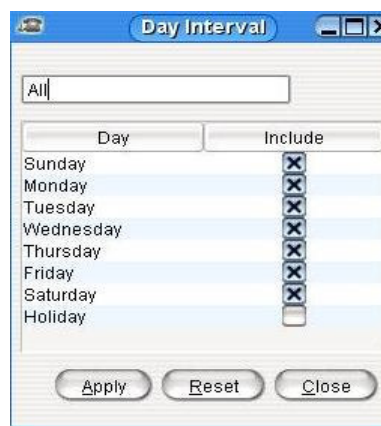


Point to note is the tree-progression of the menu options in a logical manner.

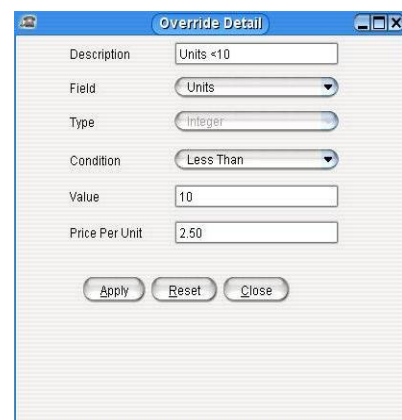
End-point configuration allows the user to set varied combinations for Origin and Destination. This can be useful if the customer wishes to have different call charges based on distances or locations.



This screen shows the **time combinations** that can be configured for varying the call charges



Shows the **day combinations** that can be configured for varying the call charges



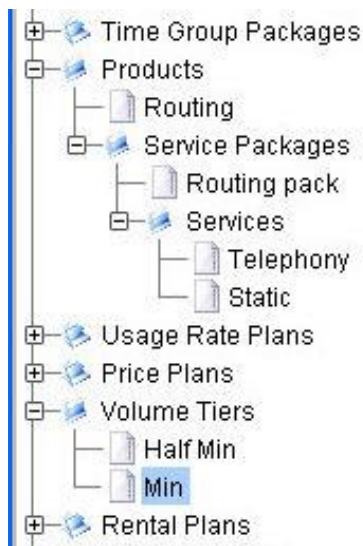
Override can impose any rating rule that is set here onto a given call



Configurable Rate Plans

The SmartBilling system offers a number of service options which are also configurable. Services like Rental plans, Subscribable items, Taxes, etc are the important options that have not been hard-coded, and instead they have been made configurable to meet any future business challenges or opportunities.

The RatePlan as is evident is an integration of these Service options and the Call charge settings that have been applied.



User Interface

The GUI of the SmartBilling system is an extremely logically designed interface, which replicates the process flow of an HCC service provider. A major design innovation that has been applied is the use of a Tree-structured menu, instead of conventional drop down menu. The advantage being that it lays down the configuration sequence, hence the user does not have to memorize or learn the steps of configuring the system. The sequence starts from the bottom-most node up.

Technology

Database

SmartBilling uses another innovative approach in terms of data storage, which speeds up save operations significantly considering the volume of data getting generated in such HCC services. A typical CDR would be approximately 300 bytes in size and an HCC service provider would be processing well over a couple of million calls daily, with not only negligible time-gap between calls but also in most situations multiple calls might be processed simultaneously. In such a scenario it's crucial to have an extremely efficient storage mechanism, which would be fast as well as perform multiple write-operations simultaneously.

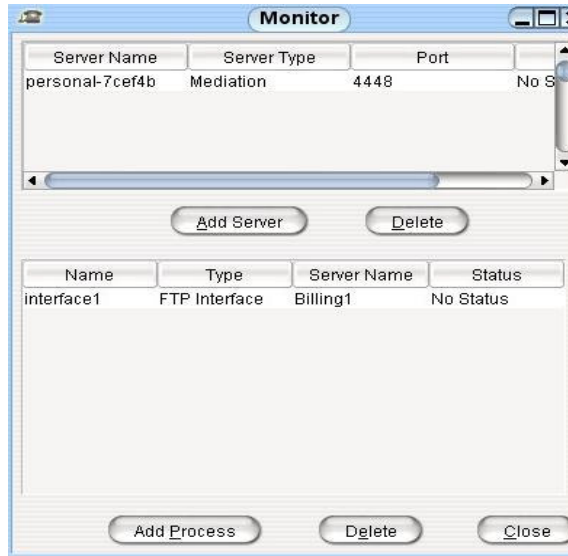
To meet this demand, the SmartBilling system uses the concept of a cache database for interim storage and at pre-determined time intervals the data from the interim storage is transferred into the primary database for permanent storage. All of this is executed by separate threads, which are not involved in the CDR mediation, rating or billing. Hence the CDR processing as well as data storage activities can run concurrently.

In our system the cache database being used is Berkley DB 3.2.21. The reason being that BDB can support thousands of concurrent database read/write operations. Moreover as it does not utilize SQL or any predefined syntaxes for data operations, the program accessing the db is free to decide and execute any code / logic to write key:value pairs into a record. BDB also does not put any constraint on the data being stored. The concurrent read/write and absence of any complex syntax or constraint means extremely fast data storage. These benefits are not available with any standard database.

For permanent storage of data the system uses MySQL Cluster 5.1, its an RDBMS that is capable of synchronous and simultaneous replication into multiple nodes (max 4) through a 2-phase commit mechanism. This guarantees availability of data under all circumstances.

Client

The GUI client is developed in pure Java using Swing. In order to increase the interoperability of the system, the entire communication between the client and the server has been made in XML.



Monitor Screen

Server

Processing speed – The SmartBilling system processes 20 CDRs per second under the specified configurations. The system can be tweaked to process 30 CDRs / second (at the moment) with additional hardware, which will hit a figure of roughly 2.5 million CDRs in a given day.

Distributed processing – The SmartBilling system owing to its multi-threaded and modular architecture is capable of distributed processing. This feature is further enhanced by the inherent capability of MySQL Cluster 5.1 to utilize distributed processing.

Remote administration – The SmartBilling system can be accessed remotely by a designated administrator and most importantly the Monitor module, which is used for start/stop of all the Managers and related processes, can also be remotely administered.

Benefits

Business enabler

Today's telecom service providers are faced with a very volatile technological scenario where advancements and new features are being announced at a very fast clip. And it becomes critical to devise new services, which fully exploit these advancements. Hosted IP-based Call center services is such a technical possibility that has recently dawned. In order to make HIPCC a reality, we need an efficient, robust and reliable billing system, which would be the backbone of the hosting services. Thus SmartBilling enables a new service – HIPCC.

Flexible business plans

Service providers can provide very flexible and hence usage-friendly business plans to their customers, as because a vast number of factors that can affect call charges have been made easily configurable under the SmartBilling system. Factors ranging from distances, day-of-the-week, time-period, volume of call to pulse rates, every conceivable factor has been made configurable and not hard-coded. All these are ultimately integrated into various rate plans.

Data availability

Owing to the unique database architecture used for the SmartBilling system, data availability is always guaranteed. Any storage media failure will not be able to halt the provision of data for billing or invoicing.

ROI

SmartBilling system falls into a category of software, which is not simply meant to be a productivity-enhancing tool. It's an application, which opens a hitherto unknown and unavailable revenue-generating avenue for the company. The value of SmartBilling system cannot be measured in terms of short-term productivity growths; it can be measured in terms of providing a new service vertical to the company.

System requirements

SmartBilling has certain specific hardware and software requirements that are needed to ensure an optimal operation of the system.

SmartBilling Server – Hardware requirements	
Processor	2* ProLiant DL380G5/(1) Dual-Core Intel Xeon 5130 Processor (2.0 GHz, 1333 FSB)/4MB (1 x 4MB) Level 2 cache
Memory	4GB (2 x 2 GB) PC2-5300 Fully Buffered DIMMs (DDR2-667) with Advanced ECC, mirrored and online spare memory capabilities
NIC	Embedded Dual NC373i Multifunction Gigabit NICs
RAID	Smart Array P400 Controller with 256MB cache (RAID 0/1/5)

SmartBilling Database – Hardware requirements	
Processor	1* ProLiant DL380G5/(1) Dual-Core Intel Xeon 5130 Processor (2.0 GHz, 1333 FSB)/4MB (1 x 4MB) Level 2 cache
Memory	4GB (2 x 2 GB) PC2-5300 Fully Buffered DIMMs (DDR2-667) with Advanced ECC, mirrored and online spare memory capabilities
NIC	Embedded Dual NC373i Multifunction Gigabit NICs
RAID	Smart Array P400 Controller with 256MB cache (RAID 0/1/5)

SmartBilling Software Requirements	
OS	RedHat Linux 10 Enterprise Edition
Database	<ul style="list-style-type: none"> o Berkley Java DB 3.2.21, o MySQL Cluster 5.1
Runtime Engine	JRE 1.5
Web server	Tomcat Server 5.0

Market Analysis

The concept of providing hosted call center services is applicable to customers, who neither possess requisite infra and resources to setup their own call center, nor are they interested in going in for such a liability. Companies interested in such hosted contact center services are increasing by the day and according to figures given by Gartner and IDC this is still in nascent stage.

Any service provider who wants to provide such hosted services to interested companies, must have a reliable service billing backbone in place, which is fast, accurate and configurable to the extent required. This is critical for survival and business growth.

Future Prospects

The focus will be to incorporate the below mentioned features into the future releases of the SmartBilling system.

Multi-format CDR support

The current version of the SmartBilling system is capable of reading only ASN and CSV formatted CDRs, which are specific to CTI vendors like Alcatel and Genesys respectively. In situations where a separate CDR format would be required to be rated, our future version of SmartBilling would be capable of doing that. Any format of CDR would be accurately mediated, rated and billed.

Multi-utility CDR

The CDRs that SmartBilling currently processes contain information regarding call details only. But other modes of contact utilized by the service providers like voice message, short messages, voice mail, etc are not accounted for in the CDRs and hence are not rated or billed by the current system. Future releases of SmartBilling will be capable of processing non-call details from a CDR also.

Web-based Front End

The current GUI of the SmartBilling system is based on Java Swing and hence is a desktop application that would need Java to be pre-installed on the machine. But that would not be so in case of a Web-based UI. The plans are to develop a similar UI for SmartBilling using JSP as the underlying technology. This is all the more significant, where customers using the hosted services would like to monitor or access their information remotely from PCs which might not necessarily have Java installed in them.

Dynamic rate plans

The Rate plans under the current system are pre-configured by the service provider and the customer is displayed the available rate plans from which they have to select. Future business enhancements might necessitate the availability of Rateplan configurations with the customer itself, so that they can tailor-make a rate plan in accordance to their requirements and get billed in accordance to that plan. Future release of SmartBilling will make this facility available.

Processing speed

The current processing speed of the SmartBilling system is at 20 CDRs per second, which can handle approximately 1.7 million calls per day. The future release will be equipped with scalability to process upto 100 CDRs per second, in other words handle approximately 8.6 million calls per day!

Reference Documents

The SmartBilling user guides and reference documents are available at the URL mentioned below. Please feel free to refer to them –

<http://122.161.0.215:3080/twiki/bin/view>

Contact information

For more information on SmartBilling system for Hosted IP contact center service providers, please contact us at the details mentioned below –

Technical queries –

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Your suggestions and customization requirements are most welcome, so that we can provide CallDesk suited exactly to your requirements. Please contact us at the following detail –

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