iAcuity Telco

# iRevenue Assure

## DATA SHEET

# Advantages and Implementation of iAcuity Telco Revenue Assurance Solution



## Executive Overview

Telecommunications systems nowadays have evolved to the point that numerous modes of exchange of information are available, based on both a traditional variety of means and protocols (traditional wireline telephony) and more advanced technologies (GSM, GPRS data, VOIP etc.).

Taking advantage of these new technologies, telecommunication network operators have been able to offer a wide variety of services, which are continually increasing. The potential economic risk associated with the variety and competitive capacity for services has consequently increased and stems from a potential misuse of available services at the expense of both the service providers and the end users. These phenomena can generally be traced to a "traffic anomaly ", that is, a condition in the use of a service for which it will not be possible for the service provider to obtain compensation or for which payment will be levied from an end user who is unaware that these services have been provided. In the first case a direct loss for the service provider can be estimated (lost profit) whereas in the latter, an indirect loss needs to be evaluated, due to a lack of confidence by the end user in the service provider's reliability and security which may eventually result in the loss of a customer.

Experts recognize that telecom revenue leakage is considered the most significant threat to today's telecom network operator- each year leakage is estimated to cost operators somewhere between 6 – 12% of revenues and the effects are contagious and affect the entire organization. To effectively compete in the open telecom marketplace, a telecommunication operator has to establish sound processes to reduce fraud and maximize revenue- as the new business systems and services are continuously introduced, the revenue assurance solutions should be able to detect and allow the business analysts to quickly configure the system with new rules in order to detect and fix leakages as soon as they are discovered.

iAcuity Telco Solutions proposes, a very flexible innovative Revenue Assurance System. This product allows traffic to be monitored, highlighting all "anomalies" which could indicate an incorrect use of services, providing a flexible, easy to use environment for the control of suspicious events and allowing an automatic interruption of specific services to be implemented if particular conditions arise.

As service types and service operation are continually evolving, is highly flexible and it can be readily adapted to new and differing service modes and service pricing and can incorporate increasingly complex techniques and heuristics for the automatic identification of traffic anomalies.

iAcuity Telco Solutions caters to the following functionality for assuring the telecom revenue to the operators

- Integrity of Chargeable event, billing and settlement
- Policing of customer and operator activity
- Accounting data accuracy assurance and correction
- Reconciliation and analysis of revenue data

Revenue Assurance solution maps data from various systems including the Billing and customer care, financial and accounting systems to create a dashboard comprising visually representing the data in various statistical models including graphs, charts etc.

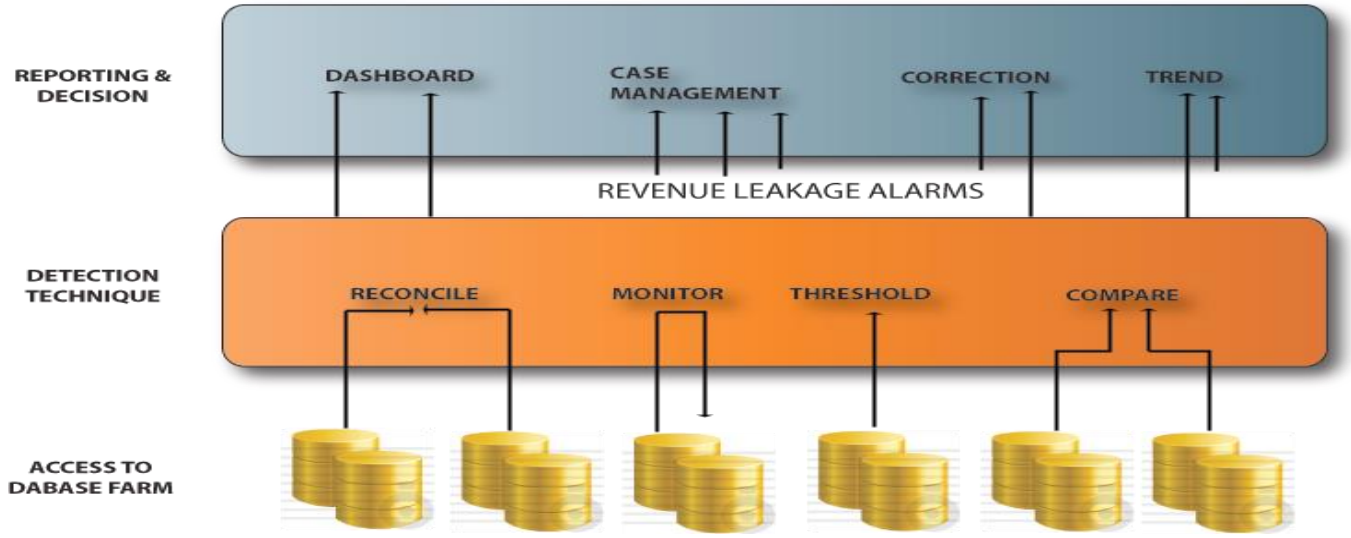
## iRevenue Assure Revenue Assurance Functionality

iRevenue Assure have the capability to monitor event sources and business processes like tariff creation/maintenance and customer maintenance.

- Monitoring logic shall be extensible to include any aggregated data or revenue assurance metrics.
- A GUI front;end specifically for Revenue Assurance shall be available for intuitive monitoring of defined metrics.
- The GUI presentation of the Revenue Assurance module shall include useful diagrams like pie charts and bar graphs with drill;down capability.
- The revenue Assurance module shall detect changes to establish trends and reports exceptions (and assign actions) for investigation and correction.
- Revenue Assurance metrics shall be stored in separable database from production to minimize impact to production environment.
- The revenue Assurance module shall allow operators to investigate exceptions and correct errors in the rating and billing process that are caused by collection and business processes failure in daily business operations.

Statistical and trend analysis facility is an integral part of the system.

Based on the input sources and implementation, the following initial set of reports is recommended as part of the revenue assurance program and initial implementation phase. During this phase the degree of variation against the integrity of the systems are generally very high, however as processes and audit process get streamlined, the gap reduces and the reporting integrity can be achieved. As maturity andprocess evolve, more and more comprehensive and integrated report sets can be targeted apart from providing a corporate dashboard based on various parameters.




### Functional Architecture

While the first three features above are achieved by the product, the revenue reconciliation is achieved through a specific Reconciliation Tool, since reconciliation requires high end transaction processing and comparison of data on large scale.

iAcuity Telco Solution's iRevenue Assure provides a complete configurable framework where data is captured and analyzed with various business rules to check the integrity from the network perspective, systems as well as people perspective.

Various measurements and metrics are collected continuously to analyze the Errors, failures, variations against projections as well as mismatch within the systems.

iRevenue Assure's suite of products helps in the Revenue realization and assurance. iRevenue Assure reconciliation module compares two sets of data ranging for binary to ASCII formats. The module allows choosing the data to compare like invoiced amounts, disputed CDR data etc. for any given period and generates a comprehensive statistical report.

The normalized CDRs by Billing versus the normalized CDRs by mediation and normalized CDRs by mediation versus the normalized CDRs by interconnect/Roaming systems etc., are reconciled for detection ofrevenue leakage through the reconciliation tool.

iAcuity Telco Solutions has substantial experience in implementing real time based Revenue Assurance by tapping CCS7 signaling links through SS7 probes.

## Introduction

iAcuity Telco Solutions RA solution, iRevenue Assure are highly acclaimed by number of telecom operators in Europe, South America and India. The solution is robust, highly flexible and is proven to have handled over 3 billion CDR per month, with unmatched accuracy.

- iRevenue Assure works with all the products/services provided by a telecom operator, viz.,
- Prepaid mobile – CDR & prepaid events like charging
- Postpaid mobile
- Fixed line
- Calling cards
- GPRS, MMSC, SMSC
- Roaming
- 3G / UMTS

iRevenue Assure is capable of identifying all the existing major telecom frauds, in both prepaid and postpaid services and is capable of scaling to future requirements. Some of the key areas include

- Undefined network routing for Interconnect and Trunks
- Review of CDRs getting wrongly classified by Mediation due to wrong configurations like
    - i) International Calls getting classified as Local Calls
    - ii) Intercircle roaming scenarios getting classified as Intracircle roaming
- Reconciliation of subscribers in the HLR vis-à-vis the Postpaid billing system / IN
- Reconciliation of features of subscribers as per the HLR vis-à-vis the Postpaid billing system
- Validation of the filtering rules defined in the mediation system
- Verification of the tariff configured in Postpaid billing system, interconnect billing system and IN
- Review of the toll free numbers / special numbers configured in the billing system / IN
- Review of the zero rated CDRs and CDRs rated at the default rate
- Reconciliation of CDRs between Switch, Mediation and Billing system – File level, CDR count, duration, value of each CDR
- Review of unbilled rated CDRs
- Review of billed CDRs having trans date before the billing period
- Reconciliation of duration as per Switch vis-à-vis IN system
- Reconciliation of billable customers Vs Bills Generated Vs Bills Printed Vs Bills Dispatched
- Review of the categorization of customers in the Postpaid billing system for definition of Threshold level, billing (billable / nonbailable), barring of services
- Review of CDR as per TAPIN (National / International) files vis-à-vis CDR value of usage rated (Postpaid & Prepaid)
- Review of missing TAPIN files (National / International) and the procedure for the retrieval
- Review of the Postpaid billing adjustments /disputed passed / discount
- Review of Postpaid accounts working despite outstanding revenue exceeding the threshold level for barring of services.
- Checks on barring – Threshold and Grace period validation
- Reconciliation between recharge vouchers generated Vs loaded in the IN system & delivery to different distribution points.
- Review of subscribers with negative balance in the IN system
- Review of the process of Offline charging including the range of errors
- Prepaid reconciliation i.e. Opening balance (IN) + recharges – usage +/; Adjustments = Closing balance (IN)

iRevenue Assure provides solution to monitor call transactions & network usage and identify potential fraud cases. The system generates alerts to fraud monitoring agents and tracks the status of the fraud cases till closure. iRevenue Assure provides highly scalable and extensible architecture. Easy Configuration option allows any new frauds to be easily configured in the system. iAcuity Telco Solutions has substantial experience in implementing real time based fraud detection by tapping CCS7 signaling links through SS7 probes. IREVENUE ASSURE provides a common case management and issue resolution module for Revenue Assurance, iRevenue Assure and Business Intelligence solutions.

This is a standalone web-services module that can be used to automate a services provider's chosen case management workflow, starting from case compilation to case assignment and resolution. The front-end of the Case Manager is powered by a single web-based Graphical User Interface (GUI) that presents suspected fraud cases and facilitates analysis, investigation and subsequent actions.


## Why iRevenue Assure?

iAcuity Telco Solutions today is distinguished in delivering end-to-end operation and business support capabilities that make the promise of "Simplify Business" a reality for our Clients. Our advanced telecom operational and support software along with analytical and detection technologies for service provider and enterprise networks, support critical operational and business applications. iAcuity Telco Solution's advanced OSS/BSS suite is designed to help eliminate today's barriers to efficiency, speed and performance by simplifying business control methods for the CSP's operational persons they need, when they need it. IAcuity Telco Solutions today does business in more than 4 countries around the world.

The pace of change is accelerating rapidly in the communication, media and entertainment segment. Today the competition for ARPU customers are intense than ever. Currently the communication service providers are facing the deadliest challenge balancing gross ARPU and volume. More the content and communication converges, communication service providers expect personalization and relevance to solutions and services offerings. CSPs want all these services at their fingertips regardless of time or location. And at IAcuity Telco Solutions we know that if you do not deliver, it's simple enough to switch vendors.

IAcuity Telco Solutions focuses more than 10 years of expertise into a powerful integrated team. The company along with 22 valued solutions partners, assists the world's largest communication service provider, as well as Greenfield and cable operators, in meeting their subscriber needs.

IAcuity Telco Solutions today is an undisputed leader in implementing revenue management solutions for the telecom industry and has been recognized as one of the fastest growing software companies in this space. IAcuity Telco Solutions' award-winning flagship product iRevenue Assure® and FraudTrace® — whose unique process; driven approach helps service providers improve their business and financial performance dramatically. Operators partnered with IAcuity Telco Solutions to identify and recover over $200 million in revenue leakage include BSNL, MTNL, TDM and more.

IAcuity Telco solutions' management brings more than 60 years of combined relevant experience in the communications industry. IAcuity Telco solution's product development team comprises of cross functional experts that bring expertise in revenue assurance, fraud management, BSS/OSS integration, consulting and a tremendous working knowledge of service provider operations. Unsurprisingly, peers, partners and customers have recognized IAcuity Telco Solutions as a leader in very short time.

## iRevenue Assure Features at a Glance

iRevenue Assure has a range of features with complete business focus ensuring operators to target various fraud types. Resolve cases with quick efficiency. Increase operators Return of Investment for the solution. The highlights of the solution are-

## Capability to Address any Fraud in any Environment

- Prepaid- Abnormal balances, frequent recharges, Prepaid balance not decrementing, and multiple unsuccessful recharge attempts. Call selling, internal fraud and many more.
- Postpaid- Subscription fraud, Ghost subscribers, calls selling, internal fraud, services fraud and many more.
- IP, 3G- Subscription fraud, Ghost subscribers, content fraud, internal fraud, services fraud and many more.

## Data from Any Sources

- iRevenue Assure captures data and correlates from numerous sources. This becomes even more critical aspect in the multi service operations like 3G and IP with content servers, providers, convergent mediation and rerating capability of billing systems from multi sources.
- iRevenue Assure captures raw or parsed data directly from the real-time network which is based on state of the art technology. The iRevenue Assure architecture uses adaptor technology for handling inputs, outputs and rule engine integration for maximum flexibility. At design time the user has drag and drop GUI basedaccess to configuration of parsing logic, transformation and alarm rules. The powerful run time engine allows concurrent processing across multiple processors and computing grids. This allows the Alarm rules to be executed during and after record processing providing near real time fraud detection.

## Most Comprehensive Fraud Detection System

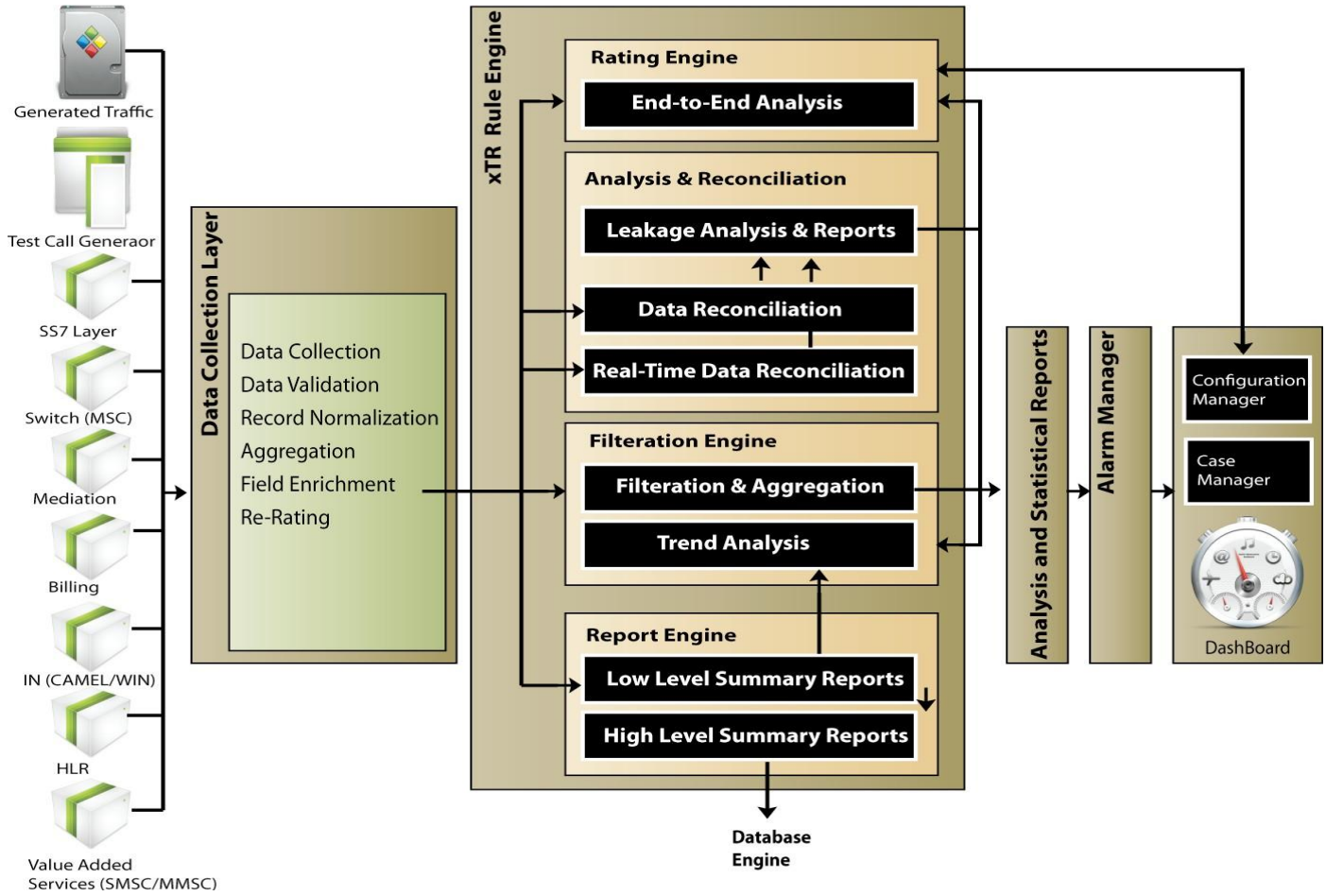
- Condition Builder- iRevenue Assure presents user configurable and definable condition builders to detect different types of fraud. User can thus define the type of fraud to check for, define parameters based on which the check can be conducted. New and existing subscriber gets monitored stringently, preventing fraud. Subscribers with some or long history on the network can be monitored with other conditions ensuring fraud like balance, bill manipulation; call selling, content misuse and others are instantly identified.
- Workflow and Alarms- The iRevenue Assure inbuilt alarm engine supports defining alarm configuration at all detection levels, analyses levels and runtime levels. Thresholds can be based on event as well as the type of alarm. System level alarms are performance and task completion alerts while process alarms are results based. Alarms have multiple levels and multiple actions, with escalation.

### State of the Art Analysis Tool

iRevenue Assure Analysis Engine uses advanced technologies from both iAcuity Telco Solutions and solution partner Tuxedo. It is comprised of the following functions-

- A trend analyzer to track key performance indicator (KPI) variations over a given time period
- An event analyzer to perform analysis of specific events, such as audit trails of system configuration changes

In case of prepaid, the solution allows tracking of subscriber balances and alerts when calls enter into negative balance on the card, indicating problems on the IN or Non;IN based SCP platform.




Key Analysis areas are

- **Record Analysis-** All call and usage data is captured in the readable and enriched formats forvaluable decision facilitating information to the system users. System user can now query and perform required investigative functions.
- **Finger Printing-** Computes and captures finger prints of all frauds detected on the system ensuring any repeat entry of the fraudster on the network is instantly recognized.
- **Link Analysis-** iRevenue Assure link analysis allows operators systems analysts to identify and understand the causes for the links and resolves multiple fraud cases or threads rather than single case resolution. The system identifies fraud rings, thus weeding out multiple fraudsters.
- **GUI Reporting-** The reporting system allows automated monitoring for Usage, Profile and Non; usage, which show different types of fraud risk. Well-defined metrics, based on easy configurable parameters such as variation in any attribute of interest like call types, duration and other parameters. iRevenue Assure allows personalized reporting by individual users and allows viewing of alerts and issues at all levels for the same or multiple users, trend analysis, various computations, and root cause analysis.

## Administration

iRevenue Assure administration system provides the system administrator to perform role based management, database administration at any level and centralized data repository management for further or future processing at any time. The system allows the monitoring of the analysts' efficiency, track the actions and prepare better workflows.

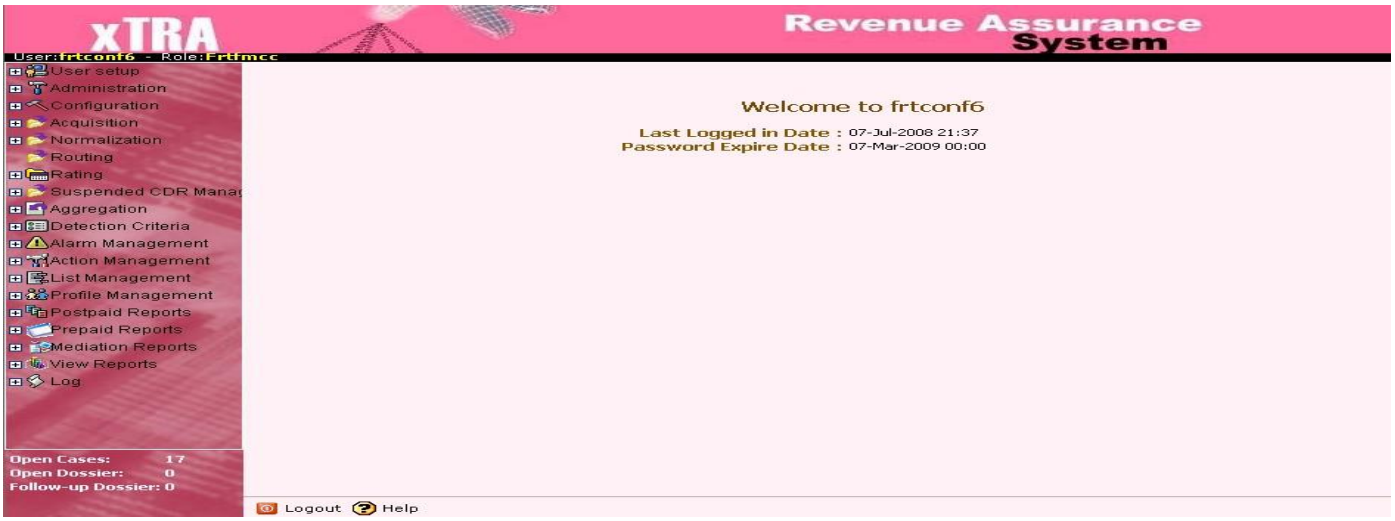
## Empowers Faster Decision Making Process

False or Unnecessary Alarms can create issues and generate workflows with the provision to auto; close issues. iRevenue Assure notification mechanism can integrate with email systems, various messaging systems,

middleware systems, third party monitoring and alarm tools. iRevenue Assure has the capability to generate critical alarms over mobile reporting system by using the existing SMSC gateways and also has the unique power of delivering automated graphical reports to critical users by using any existing MMSC gateways in regular or easy configured intervals.

## iRevenue Assure Technology




A reliable and flexible mechanism for the identification and control of these "Traffic Anomalies" would offer two major advantages-

- It would allow the service provider to reduce direct economic costs by identifying and interrupting an incorrect use of the service (before this can come to represent a significant cost)
- It would implement an efficient mechanism for customer retention allowing the service provider to "protect" authorized end users from unwitting use of services, limiting subsequent economic impacts.

## Network Coverage

Various network elements and systems are to be covered to detect the frauds viz.,

- Radio Access Network (BSS/RAN)
- Mobile Switching Center (MSC/NSS)
- Home Location Register (HLR/VLR)
- Intelligent Network (IN)
- Messaging (SMSC, MMSC, USSD, VMS)
- Packet data (GPRS, EDGE, 3G/UMTS)
- Network Management (NMS, OMC, OSS)
- Mediation, Billing, Customer Care, and the OSS

## Revenue Leakage Areas

| Sl. No | RA Feature | Input Data Sources | Feasibility |
|---|---|---|---|
| 1 | Undefined network routing for Interconnect and Trunks | 1.MSC CDR Data<br><br>2. Trunksdetails from BSNL<br><br>3. Call scenarios for these trunk groups | All the Trunk groups get loaded as part of the reference data. The call scenarios in which these trunk groups should be usedshall be part of the business configuration. Using the MSC CDR data, the deviations to the reference data and call scenarios shallbe detected. |
| 2 | Review of CDRs getting wrongly classified by Mediation due to wrong configuration<br><br>i) International Calls getting classified as Local Calls<br><br>ii) Intercircle roaming scenarios getting classified as Intracircle roaming | 1. Converted ASCII data from Mediation System<br><br>2. Rules for Prepaid / Post Paid segregation<br><br>3. Rules for Segregating call type ; STD / ISD | The rules for segregation Prepaid and Postpaid as well as Call Type shall be configured as part of the business rules in the application. Typically, these rules are based on Numbering levels or some indicators in the CDRs. Use an alternative indicator for determining the same, for e.g., a prepaid / postpaid CDR is segregated based on the IMSI/ Numbering level.<br><br>Another way of determining the same is using CAMEL flag. Both rules shall be incorporated into the application and MSC converted CDRs are processed and any deviations to the logic can be highlighted. This can be done as a one-time exercise to start with and can be continued periodically or whenever there are changes to the business rules in the mediation. |

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| 3 | Reconciliation of subscribers in the HLR vis-à-vis the Postpaid billing system / IN | 1. Subscriber list from each HLR along with features available including I/C call availability, O/G call availability, SMS, MMS, GPRS, National Roaming, International Roaming, STD and ISD<br><br>2. Subscriber information from IN system<br><br>3. Subscriber information from Postpaid Billing System including I/C call availability, O/G call availability, SMS, MMS, GPRS, National Roaming, International Roaming, STD and ISD | Reconciliation can conducted of all the subscribers from both the databases along with their features |
| 4 | Reconciliation of features of subscribers as per the HLR vis-à-vis the Postpaid billing system | 1. Subscriber features from the Billing System.<br><br>2 same features from the HLR | |
| 5 | Validation of the filtering rules defined in the mediation system | 1. Mediation Data.<br>2. Rules defined in Mediation | Same as #2 |
| 6 | Verification of the tariff configured in Postpaid billing system, interconnect billing system and IN | 1. Tariff list from the three BSs.<br><br>2. Rated CDRs from the three billing system | This can be done on a sampling basis by collecting rated CDRs and applying the same tariff structure once again and compare if there is any difference between both the rates. |
| 7 | Review of the toll free numbers / special numbers configured in the billing system / IN | 1.List of all Toll free numbers | This can be generated as a report on a periodic or daily basis. |
| 8 | Review of the zero rated CDRs and CDRs rated at the default rate | 1.Rated CDR from the Billing System | A report on all the Zero rated CDRs can be generated on daily basis. For the CDRs rated at default rate shall be part of the #6 |
| 9 | Reconciliation of CDRs between Switch, Mediation and Billing system – File level, CDR count and duration, value of each CDR | 1. MSC Raw CDRs<br><br>2. Rated CDRs from Billing System<br><br>3. MSC ASCII CDRs from | Reconciliation can be done between MSC Raw CDRs and Rated CDRs. Another set of reconciliation can be done between the CDRs converted by the Mediation System and the CDRs converted by RA system. |

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|---|---|---|---|
| | | Mediation | |
| 10 | Review of unbilled rated CDRs | 1. Discarded CDRs from Billing System | Wrongly filtered CDRs at the mediation level are handled by #2. The Unbilled Rated CDRs are to be taken from the discardedtable of Billing system and a report shall be generated |
| 11 | Review of billed CDRs having trans date before the billing period | 1. Rated Records | Customized adapter / query may be run on the rated CDRs to see if there is any trans date after the Bill Cycle but belongs to the previous Billing period. |
| 12 | Reconciliation of duration as per Switch vis-à-vis IN system | 1. Switch data by filtering the prepaid<br><br>2 CDRs from IN system | Reconciliation can be conducted between the two databases |
| 13 | Reconciliation of billable customers Vs Bills Generated Vs Bills Printed Vs Bills Dispatched | 1. Bills generated<br>2. Bills Printed<br>3. Bills Dispatched | This data needs to be collected from the postpaid Billing system. Currently the Bills are printed and dispatched from locations other than retail billing Data center location. Hence the physical status of whether the Bill is really dispatched is not possible to know. However, if the information that is available from the Billing system, same can be used as areference point to generate this report |
| 14 | Review of the categorization of customers in the Postpaid billing system for definition of Threshold level, billing (billable / non-billable), barring of services | 1. Accumulated charges for all subscribers till date<br><br>2. Set Threshold per Subscriber details from every Bill cycle<br><br>3. List of service barred | Usage summary for different category of subscribers can be generated against each of the services based and a report shall be generated against the Threshold levels |
| 15 | Review of CDR as per TAP-IN(National / International) files vis-à-vis CDR value of usage rated (Postpaid & Prepaid) | 1. TAP-IN Files<br><br>2. Tariff Structure for National and International Roaming | The Tariff rules for national and international roaming are configured in the rating engine. The TAP; IN files are rated and compared against the value provided inthe rated CDR and any discrepancy can be alerted. Specifically, the rules for defining and rating the International files needs to clearly defined. Current practice is only to sum up the rate in the records. |

 

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| 16 | Review of missing TAPIN files (National / International) and the procedure for the retrieval | 1. TAP; IN files<br>2. Naming convention of the TAP files for each of the agreements | Verify the missing sequence, operator wise in case of International files and zone wise for National files. However, if files are not received at all then nothing can be done.One other way is to set frequency of receiving files from each operator and if the same are not received after the duration, generate a report. Typically, this is the job of the roaming module of any GSM Billing solution. However, if this is required, same shall be done as custom application |
| 17 | Review of the Postpaid billing adjustments /disputed passed / discount | 1. Bill adjustments<br>2. Dispute Passed<br>3. Discount offered at summary level | Customized report can be developed |
| 18 | Review of Postpaid accounts working despite outstanding revenue exceeding the threshold level for barring of services. | 1. Outstanding revenue<br>2. Set Threshold per Subscriber details from every Bill cycle<br>3. List of active subscribers | Custom report can be generated based on the periodicity of the availability of the Outstanding revenue from each subscriber |
| 19 | Checks on barring – Threshold and Grace period validation | 1. Accumulated charges for all subscribers till date<br>2. Set Threshold per Subscriber details from every Bill cycle<br>3. Grace Period for every subscriber | Customized report can be developed |
| 20 | Reconciliation between recharge vouchers generated Vs loaded in the IN system & delivery to different distribution points. | 1. Recharge Vouchers generated<br>2. Recharge vouchers loaded in IN system<br>3. Data from distribution points | Customized report can be developed |
| 21 | Review of subscribers with negative balance in the IN system | 1. CDRs from the IN system<br>2. Account Balance for each subscriber | Reconciliation of CDR value from a day vs. the difference of balance between two days |

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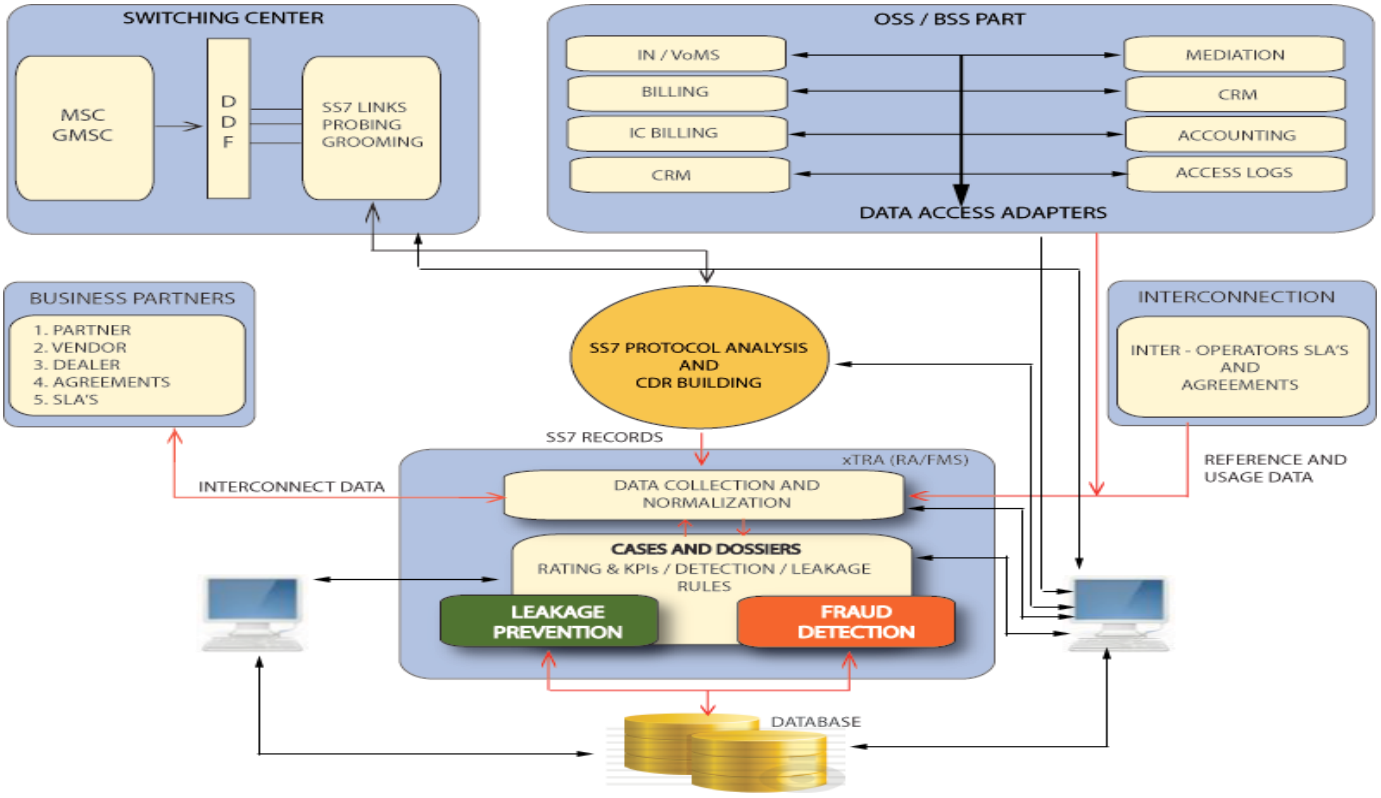
| 22 | Review of the process of Offline charging including the range of errors | 1. Non chargeable IN CDRs | Daily report on the offline charging from the IN system |
| 23 | Prepaid reconciliation i.e. Opening balance (IN) + recharges – usage +/; Adjustments = Closing balance (IN) | 1. CDRs from the IN system<br><br>2. Account Balance for each subscriber<br><br>3. Recharges | If the objective is to check the integrity, since the data set is dynamic, the result will not be accurate in many cases unless the opening balance query is given from an exact time like 12.00 AM or 4.00PM for all the subscribers. It is the same case with the closing time as well. |

## iRevenue Assure Architecture

iAcuity Telco Solutions envisages the following interface architecture as per the diagram given below to collect data from various sources and process for iRevenue Assure.

iRevenue Assure collects data from all network elements of the network through data mediation. Apart from this the data is collected real-time from various MSCs. iRevenue Assure can also exchange FIGS related information with Network Elements. The fraudulent cases are routed to the analysts' terminals for appropriate action.

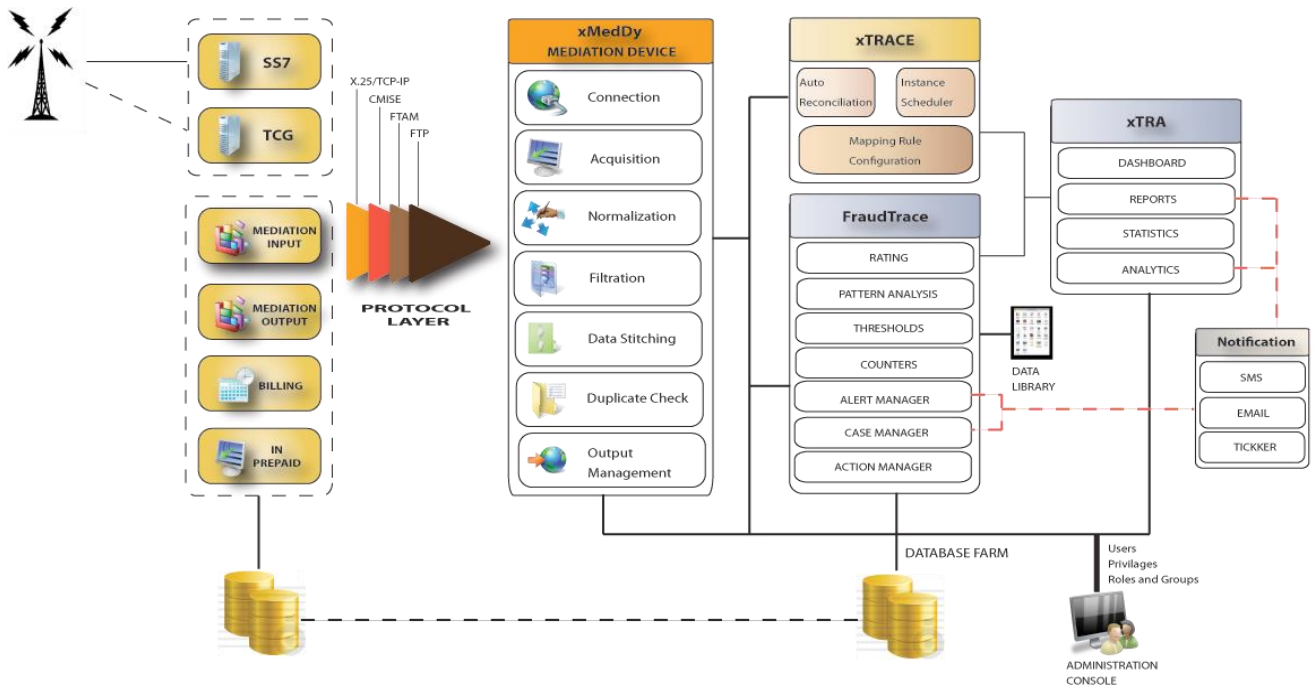



### Section 1.01 Solution Description

iAcuity Telco Solutions product iRevenue Assure is a very flexible & innovative iRevenue Assure system, to monitor traffic, highlighting all "anomalies" which indicate an incorrect use of services due to suspicious events and allows an automatic interruption of specific services to be implemented if particular conditions arise.

As service types and service operation are continually evolving, iRevenue Assure is highly flexible and it can be readily adapted to new and differing service modes and service pricing and can incorporate increasingly complex techniques and heuristics for the automatic identification of traffic anomalies.

System customization is achieved through a third generation language that allows the system to be configured rapidly to fit changing needs.




In addition, logging of all events and auxiliary data allows for a detailed analysis to be carried out off-line. This is useful in evaluating system behavior and in conducting "what; if" scenarios, allowing for efficiency and economic return to be monitored constantly.

Since time to alarm generation is a major factor for the correct behavior of the system, it is important to retrieve data, as close as possible, to the source of service (for example, the switching center).

To this aim, the system can be configured to receive input from the closest available source (billing data, mediation device, switching centers); it reduces the latency between the time of generation of the event and the identification of the anomaly, bearing in mind that the time to alarm is directly proportional to the economic loss incurred for a missed identification.

Our approach is to deliver a flexible and configurable solution that supports you in achieving your objective. The solution must be able to evolve with the future needs of the customers. The solution achieves it in a number of ways;

- iRevenue Assure solution manages different incoming data flows in a real convergent way- due to the application architecture it is possible to increase the number data types that are analyzed according to needs and future development of the technology. It is not being necessary to change the iRevenue Assure platform or to develop ad hoc code.
- At the same time, the system can be configured with new rules as soon as new fraud techniques are discovered. Also in this case, the flexibility of the solution, with the easy to use console, allows the telecom operators to react to frauds without the need of developing a specific solution.

The main benefits of iRevenue Assure are the following-

- It is highly configurable according to new data input
- Management of multiple input data format
- Hardware and Software independent
- Configurable data flows within the systems

- Configurable internal record format Database is independent from data format (external and internal)
- WEB interface, no clients' maintenance, Multilingual
- High scalability
- Modularity of the solution
- Secure access with smart card systems (if required)
- Encryption on DB and secure connection with WEB
- Short time required for Integration
- Distributed configuration, even between multiple sites

iRevenue Assure is already running for wire line, wireless and UMTS carriers and are based on the state of the art technology and is available for SUN/Solaris, HP/HPUX, Linux and AIX platforms for the server side while the GUI is fully WEB; based.

- iRevenue Assure comes with a ticker application that can reside on desktop and pops up a visual and audible alert as and when a fraud case is raised

## (a) Data Collection

The data that is acquired can be broadly categorized into

- FIGS data
- Mediation CDR
- Billing CDR
- Customer account / profile details
- IN CDR
- Voucher management system
- Switch Transaction log
- OMC Transaction logs
- Switch subscribers' data
- Commercial Transaction Logs
- Subscribers data set from central -site

## (b) Reference Data

Reference data is stored in appropriate data structure suitable to be read by Data Analyzer module at the startup, in order to access the data with the required level of performance.

On the other hand, service usage data is sent by Acquisition to the Normalization module configured to translate incoming records in a unique normalized record format; translation rules are to be configured via GUI using the Modula native SQL-Like language that gives the highest level of flexibility in introducing new data flows in the system (note that SQL-Like language is widely used across several modules).

Normalized data flow is sent to the Rating module in charge to rate the event- Rating uses a flexible algorithm based rating method that allows to cover also sophisticated rating plans- also to add new rating plans is a matter of configuration so no classic development activities are needed.

Rated data is ingested by the Data Analyzer module, a generic, real time, rule based fraud engine- its extreme flexibility is gained through the extensive use of SQL-Like language to define rules, patterns, etc. allowing configuring new rules and putting them on-line in the shortest time (even minutes). This approach is aimed to cover all known fraud techniques and to decrease the reaction time after a new fraud type is discovered.

At this point service usage data (i.e. CDR) signals and cases are stored in the data repository, this can be saving data on Oracle DB or on indexed file structure or on near-line devices (DVD juke box) allowing, by means of performance retrieval techniques, access to recent and historical data during fraud investigation.

Data Analyzer produces signals that are correlated each other by Case Filter module in order to avoid case proliferation.

The web-based interface offers three access channels to system data-

- Configuration interface
- Case Management Workflow
- Reporting and Monitoring

iRevenue Assure GUI is web-based, allows secure connection (SSL), user profiling, smart card access control, external user DB interfacing (LDAP) and provides multilingual support.

System manages use of the data for the following functionality-

- Local Customer Info- Through this interface changes on local MSC subscriber data gets collected and checked against centralized subscriber database to highlight discrepancy.
- Net-Operational Log- Through this interface logging information coming from MSC gets collected and analyzed highlighting potential fraudulent configuration actions.
- Call-Events- These are collected via probes on CSS;7 signaling links to get all, relevant calling events, to track subscriber activity and actuate relevant fraud detection control on traffic.
- CC-Operational Log- Through this interface local customer care operation are collected and analyzed highlighting any potential fraudulent activity on subscriber configuration.
- Customer Info- Through this interface, subscriber relevant data is collected to align with subscriber database, via FMS-Coordination data interface, these updates are forwarded and shared with other nodes, same flows can be collected both from CRM local sub-system and Billing local sub-system. This will allow identification of any discrepancy.
- Rated CDRs- Through this interface all charged billing events gets collected (from local billing system) and further matched against traffic events highlighting major discrepancy.
- Billing Operational Log- Through this interface, all activities performed on billing system can be tracked in order to highlight any potentially fraudulent action aiming at fraudulent subscriber configuration.

Fraud analysts will be able to access the system via client workstations managing relevant cases according to the defined work-lists.

Fraud analysts can take action against identified fraudster manually by (via standard iRevenue Assure WEB interface), or automatically by the system as per the appropriate rules that are defined

## (c) Off the Shelf Network Anomalies Handler

Ideally, fraudulent activity is to be identified whilst it is still in progress; this is known as 'real time' fraud detection. CDRs must be rated before being analyzed and this normally occurs as they pass through the billing & mediation system. For true real-time fraud detection iRevenue Assure must gather data directly from the network using SS7 probes as a mechanism able to interpret data as it transits- Those data can be fed into the iRevenue Assure and certain fraudulent activity (like abuse of test lines, callback fraud, long calls, etc.) can be identified as it occurs.

Some of the critical fraud types that can be detected are-

- Prepaid Anomaly ; Including recharging of service (an interface to the voucher management system is required to collect information on the recharging activity of customers); Check on MSISDN not recharged after a configurable number of days.
- IN Anomaly – Reconciliation of call value & voucher recharge amount, to identify; IN call value more than voucher value; IN call validity more than the expiry date of the voucher; excess prepaid roaming usage; Masking IN CDRs; Tampering with IN rating logic
- Subscription Anomaly – A subscriber profile is created from his/her past usage data and account details to identify; Account creation using a faked name or address; usage more than 1.5 times the profile values. Applicable for postpaid services.
- Internal Anomaly; Illicit activation of unbilled services; Tampering with billing / rating system to result in zero value / zero duration calls; unauthorized bulk activation or deactivation; Multiple opening & closing of an account within a billing cycle. Applicable for both prepaid and postpaid services
- Forwarding & Conference; Abnormal high usage of facilities, either on home network or while roaming, especially within first couple of days of service activation
- Dealer Anomaly; Fraudulent activations to gain unearned commissions; Applicable for both prepaid and postpaid services
- Technical Anomaly; Including clip-on, PBX and wireless cloning; Applicable for both prepaid and postpaid services
- Premium Rate Service; High number/value of calls being made to PRS list that is more than twice the normal PRS calling behavior. Applicable for both prepaid and postpaid services
- Dialed Digit Patterns; Consecutive calls with related dialed digits, e.g. incrementing numbers, which might indicate computer based hacking of services; Applicable for both prepaid and postpaid services
- Collision Anomaly; Whether the subscriber has made more than one call/event at the sametime; Applicable for both prepaid and postpaid services
- Velocity Check; Detect consecutive calls/events where the travel time between the locations of the cells where the two calls/events originated is infeasible; Applicable for both prepaid and postpaid services
- Usage of handset with multiple IMSI and vice versa; As indications of possible attempts at cloning or manipulation of handsets. Applicable for both prepaid and postpaid services
- Hot lists & Black lists – Known low usage origins / destinations; Acceptable high usage destinations; Known HOT origins / destinations and cell Ids; A/B number exclusion; calling cardHOT destinations; Blacklisted IMEI / IMSI as known to the network; HOT and frequently called PRS numbers. Applicable for both prepaid and postpaid services

The system is able to generate alarms in particular cases that hide a potential fraud-

- A call record has been received for a service number or subscriber, unknown to the system, and detects ghost phones that are on the network, but not in billing system.
- When calls/events are made to certain specified numbers (e.g. black list numbers), number ranges, suspicious area (cell site) or countries.
- Changes in calling patterns per subscriber profile.
- Multiple subscribers with same usage pattern.
- Excessive usage based on the number of calls, value of calls and or usage beyond a subscriber's normal usage pattern.
- Call record received for a service number or subscriber who is using a class of service for which he/she is suspended;
- A number of short duration calls are made to the same destination;
- Excessive usage of "Call transfer" and "Call forward" features;
- A subscriber - defined duration threshold is exceeded for an individual call/event;
- If a subscriber calls more than a specified number of different countries within a specified period of time;

- If more than a specified number of subscribers call the same phone number within a specified period of time;
- A subscriber is receiving only international calls from a specific destination;
- Particular recharging actions.

Alarms generated by iRevenue Assure can be delivered to the appropriate personnel using email, pagers and SMS, general monitoring systems or other means.

In addition, the system is able to generate automatic notification to a roaming partner if a roaming subscriber exceeds any thresholds generating the High Usage Report.

## Section 1.02 Product Structure

The product structure is based on basic modules (that are able to work in parallel to increase system throughput) that create a processing "chain" integrated with the middleware. The system and its configuration can be fully controlled through a WEB based interface integrated with the system as a whole through J2EE compatible application servers.

The main modules composing iRevenue Assure are-

- Acquisition
- Normalization
- Rating
- Fraud Detection
- Case Management

### (a) Acquisition Module

The Acquisition module enables the user to define and configure the parameters in order to acquire data for further actions.

Setting the parameters enables the user to define the data sources from which the system gathers information.

The Acquisition Module can be configured to read the following supported input data formats-

- Fixed and variable format ASCII
- Fixed & variable format Binary
- ASN.1
- XML
- IPDR
- Radius
- Mail log
- Http log
- LDAP
- OMC logs, GPRS, MMMSC etc.

The supported protocols are-

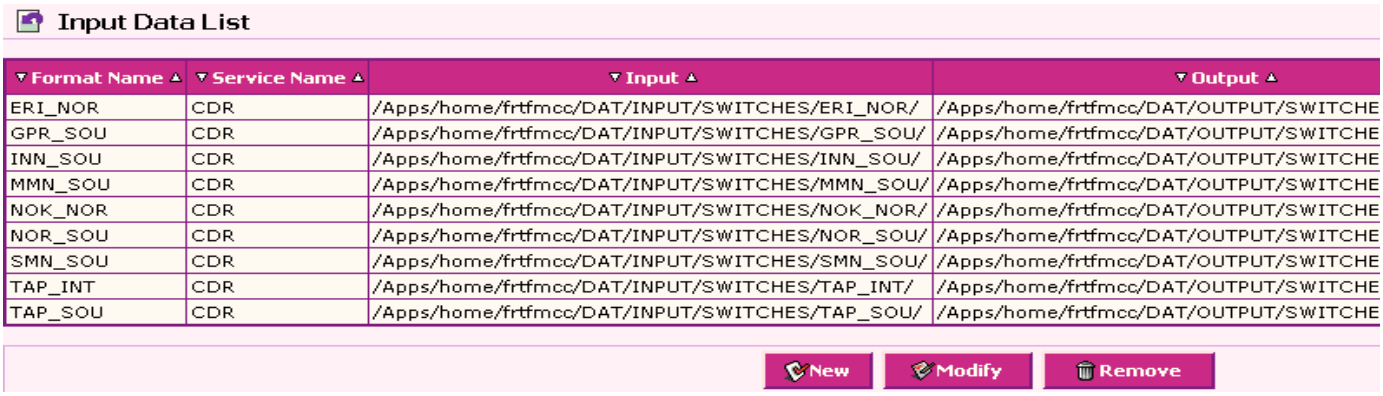
- FTP
- FTAM over X.25 / TCP/ IP
- CMISE/CMIP over X.25 / TCP/ IP
- Web services
- Mail
- Stream
- Acquisition via EAI bus (Tuxedo, WEB Methods, Tibco, Vitria, etc.)

Several parameters can be configured-

- Format name- name assigned to identify the data source in the system;
- Validity interval- the period of time when the data source is considered valid and so the input path scans must be done;
- Path- where the files we want to process are physically located.
- Polling period among two sequential path scans.
- Sequential check flag- pointing the need to make a sequential check on the coming file;
- Waiting interval of the sequential file (only when the sequential scan mode is active);
- Last sequential value read (automatically valued by the system when the sequential scan mode is active);
- Position and length, in the file name, of the specified date
- Position and length, in the file name, of the progressive number (used only when the sequential scan mode is active);
- Header flag- whether there is or not a record header in the file;
- Footer flag- whether there is or not a record footer in the file;

The "sequential file check" mode (whether activated) has the following working scheme-

- The Acquisition Module, when started, look for the file 000000; if this file is not present, at the moment, the module enters the sleep mode for a (configurable) number of seconds (polling period); then it will make a directory scan again; if in the second file scan the file is not yet found, an alarm is generated; it then skips to the next file searching;
- The searching cycle on the progressive file number is done in a range from 000000 to 999999. When the value is reached to 999999, the next progressive value will be set to 000000 automatically.
- If the Acquisition module receives a progressive number as an input (for example 000035) and the next file progressive number received is not sequential (for example 000041), it alerts the lack of all the missing files (in the example 000036, 000037, 000038, 000039 and 000040).
- Once the file has been computed (for example the file 000041), the module enters the sleep mode before doing another directory scan, that time waiting for the next file (000042);
- If the module receive as an input a file with a progressive number previously to that expected (for example 000015 instead of 000042), it computes the file then alerting that the progressive is not right.
- Erroneous records shall be suspended and investigated via GUI either if the configuration is not complete or data is really to be trashed. In case the configuration has to be changed, this can be done via GUI and related data can be ingested again via Recycle Management module.



Input Data List

| Format Name | Service Name | Input | Output |
|---|---|---|---|
| ERI_NOR | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/ERI_NOR/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| GPR_SOU | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/GPR_SOU/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| INN_SOU | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/INN_SOU/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| MMN_SOU | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/MMN_SOU/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| NOK_NOR | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/NOK_NOR/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| NOR_SOU | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/NOR_SOU/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| SMN_SOU | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/SMN_SOU/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| TAP_INT | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/TAP_INT/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |
| TAP_SOU | CDR | /Apps/home/frtfmcc/DAT/INPUT/SWITCHES/TAP_SOU/ | /Apps/home/frtfmcc/DAT/OUTPUT/SWITCHE |

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Native Fields List

| Format Name | Service | Field Name | Position | Length |
|---|---|---|---|---|
| ALC_WES | CDR | RecordType | 1 | 6 |
| ALC_WES | CDR | CallDate | 47 | 6 |
| ALC_WES | CDR | TimeOfCall | 53 | 7 |
| ALC_WES | CDR | CallDuration | 60 | 7 |
| ALC_WES | CDR | IMEINumber | 79 | 22 |
| ALC_WES | CDR | camelservice | 338 | 12 |
| ALC_WES | CDR | CallingPartyNumber | 685 | 18 |
| ALC_WES | CDR | IMSINumber | 703 | 20 |
| ALC_WES | CDR | MSCAddress | 726 | 20 |
| ALC_WES | CDR | CalledPartyNumber | 749 | 20 |

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Figure – 8 Native Fields List Screen

## (b) Normalization Module

The normalization module aims to convert the heterogeneous, native records into a unique, homogeneous, normalized record format.

For each native format defined on the system, a set of normalization rules can be specified in order to specify how the normalized record has to be constructed- the normalization rules can be modified during the system life- this is useful, for example, when, to cope with a modified situation, it is necessary to add new fields to the normalized record format.

For each field in the normalized record are defined as many rules as are the native formats defined in the system.

Each rule is defined as an expression in the SQL*Like language (a language with a SQL-like syntax, purposely invented by iAcuity Telco Solutions) where can be used constants (either numbers or strings), the set of available functions, the referenced fields of the native record using their name as it is defined in the system.

For each field in the normalized record, it is possible to define the following values.

- A symbolic name of the normalized field,
- The field position inside the record (1=first field),
- Field type (D=standard data, R=Routing Field, M=Metric),
- Low Range- once set, the record gets discarded if the field value is less than the set value. If not set, no control is made on this field;
- High Range- once set, the record gets discarded if the field value is higher than the set value. If not set, no control is made on this field;
- Values list- the record gets discarded if the field value is not present among the entities possible values, whose name is pointed in the field; if the values list is left empty no check is made.
- Default value- the value that must be used in the case it is not defined any value derivation rule starting from the fields of the input (native) record.

Once the record has been normalized, it is possible to send this record to the other modules that make the further processing.

The Routing Rules definition is made in two steps. The first is the definition, inside the normalized record, of the routing field; this field will have an integer, from 1 on, that lets the record address one or more services.

Since there can be more than one normalization service active, for each of them it is possible to define an independent routing table.

A routing rule is made by 2 values-

- Routing index- the value that can have the routing field in the normalized record;
- Service- the name of the data receiver service, that gets selected from a value list;
- Queue space- the logic space where you can find the record reception queue from the receiver service; this name is always equals to the name of the receiving service followed by "_QS".

It is possible to assign several receiving services for the same value in the Routing field- if, during the evaluation of the receiver service of the normalized service, it is not possible to find any receiving service, the record gets discarded.

Normalize Fields List

| Field Name | Service | Type | Position | Default Value | Low Range | High Range | Entity | Traffic Date |
|---|---|---|---|---|---|---|---|---|
| IMEI | CDR | S | 1 | | | | | N |
| MSCID | CDR | S | 2 | | | | | N |
| CallDuration | CDR | N | 3 | | | | | N |
| CallDate | CDR | D | 4 | | | | | Y |
| RecordType | CDR | S | 5 | | | | | N |
| IdRouting | CDR | R | 6 | 1 | | | | N |
| Temp | CDR | S | 7 | | | | | N |
| TempStartTime | CDR | S | 8 | | | | | N |
| CallStartTime | CDR | S | 9 | | | | | N |
| CallStart | CDR | S | 10 | | | | | N |
| CallStartNone | CDR | S | 11 | | | | | N |
| TempCalled | CDR | S | 12 | | | | | N |
| CalledMSISDN | CDR | S | 13 | | | | | N |
| CircleName | CDR | S | 14 | | | | | N |
| CallingMSISDN | CDR | S | 15 | | | | | N |
| Direction | CDR | S | 16 | | | | | N |
| SS7_NAICalled | CDR | S | 17 | | | | | N |
| IMSI | CDR | S | 18 | | | | | N |
| SS7_NAICalling | CDR | S | 19 | | | | | N |
| ExchangeId | CDR | S | 20 | | | | | N |

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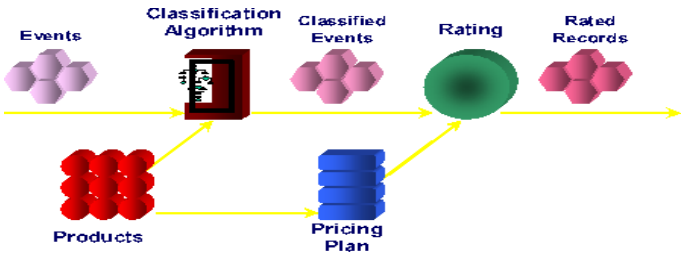
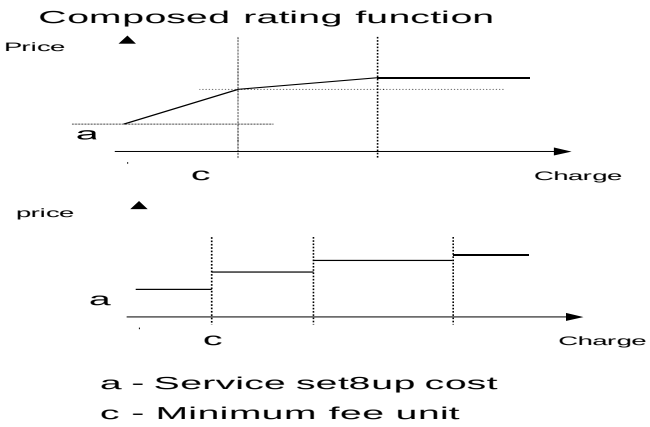
## (c) Rating Module




The Rating Algorithm enables the user to define the calculation procedure for the ranking and valorization of the generic records, by taking into consideration all the framework information and the rating element definitions.

The algorithm is an ordered sequence of steps, each of which allows the user to make a calculation or a data association, or to check on the program execution- the step number defines the line number and the order according to the lines executed.




Each line includes an operator- some operators yield a result (a variable) that may be used in the next algorithm steps or to define the value assigned to a field of a rated record.

The variables defined and rated during the rating algorithm process are one type; like variables, similar to "records" but different from the fields of the normalized record and more similar to string type variables. The variable type depends both on the operator used and on the data the operator works on.

Rating Module has the following key features-

- Event based
- Convergent

- Flexible classification algorithm
- Configurable rating and discount curves
- Multiple rating with no record duplication
- Configuration oriented (no development)

The Rating module enables each record to be rated by considering all aspects that may affect the costing process (e.g. in the case of a phone call- call type, chosen tariff plan, date and hour of call, duration, existing promotions, discounts, etc.)

A correct rating is reached by identifying a series of values for calculation. These can be identified in 3 ways-

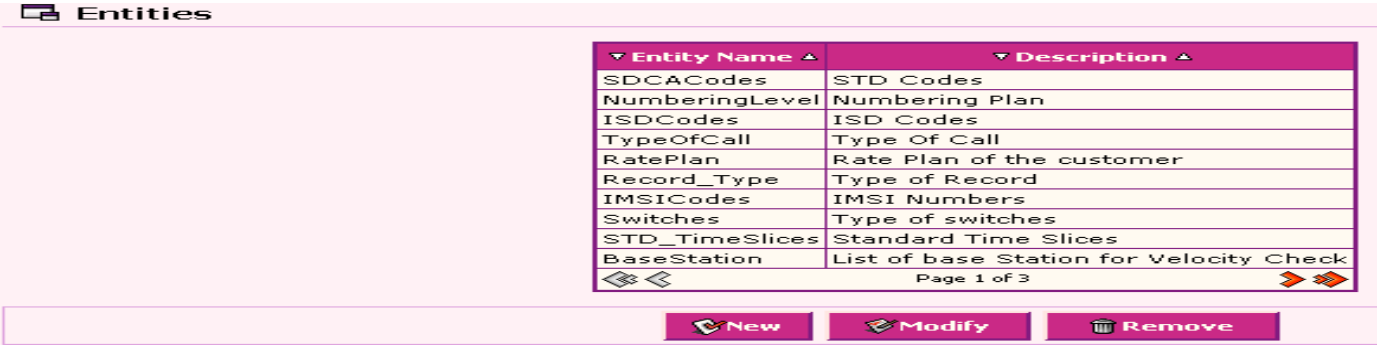
- The value is included in the normalized record and therefore immediately available.
- The value can be found by searching a value list using a particular value; taken from the normalized record; as a key with the most detailed information.
- The value is obtained through the "relations" and the combination of values gathered in the two previous steps.
- This last method can also be applied to values previously obtained by "relation".
- The system models these procedures by defining-
- Entity- values lists that can be used for mode 2;
- Relations- sets on Descartes products that can be used on mode 3;
- Rate plans- expressed as sequences of calling time (calling time start hour/end hour, day type, etc.); a cost per minute value is given to every plan;
- Holidays list- to keep record of holidays (Sundays are included by default; Saturdays may be included);
- Rating algorithm- defines the sequence of elementary steps that ensure the correct identification of the elements used in the record rating.

## (d) Entities

An entity is a list of values, identifiable with a name and compiled in such a way that every element has a number of other values as well.

Every element of an entity has the following fixed attributes-

- Name- the unique name of a particular element in an entity. It is the key through which search for the corresponding value derived from the normalized record may be carried out.
- Description- a generic description of the element that helps to identify the element.
- Every entity is thus identifiable as a set of elements, each of which has specific features.




## (e) Relations

A relation is a set of subsets on a Descartes product defined between Entities AND/OR Relations. The system allows the user to choose the framework and composition of a relation, based on all the objects configured in the system.

The simplest relation is the one-dimensional relation- in this case, given a set of values (e.g. an entity) all its elements is grouped in a homogeneous way (e.g. the central entities get grouped by geographic regions), and every subset of central entities can be given a name (e.g. Central North, Central South, Central Islands); finally, the set of group names, which forms the set of values of a relation, can generally be given the name of a Region.

Relationship Structure

| Relationship Name | Description |
|---|---|
| Parent_Nodal | Nodal Points |
| InOperType | In Operator Type |
| OutOperType | Out operator Type |
| OperNames | Operator Names |
| Parent_Circle | Parent Circle |
| NODAL_X_Coordinate | X Coordinates |
| NODAL_Y_Coordinate | Y Coordinate |
| OutChargingClassLoc | Local Charging Class |
| OutChargingClassSTD | Charging Class STD |
| OutChargingClassISD | Charging Class ISD |

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New Modify Remove

## (f) Rating Plan

Each element may be associated to a relation, such as the following-

- A Rating Plan, containing the cost per unit of calling time;
- A set of configurable and individually named User Attributes (maximum 10), each of which is based on a value that may be specified.

Rating Algorithm

| Step | Result | Operator | Subject | Parameter 1 | Parameter 2 | Parameter 3 | Parameter |
|---|---|---|---|---|---|---|---|
| 276 | CallType | SET | Constant | 'ISD' | | | |
| 277 | CallDuration | SET | Constant | '60' | | | |
| 278 | DestLocationISD | MATCH | ISDCodes | CalledMSISDN | I | | |
| 279 | ISDZone | RELATE | ISDZones | DestLocationISD | | | |
| 280 | ISDChargeClassSMS | RELATE | OutChargClassSMSISD | InOperatorType | ISDZone | | |
| 281 | CallCharge | RATE | ISDChargeClassSMS | CallStartTime | CallDuration | CALL_START_TRH.Value | |
| 282 | | STOP | | | | | |
| 283 | DestLocation | MATCH | SDCACodes | CalledMSISDN | I | | |
| 284 | DestNodal | RELATE | Parent_Nodal | DestLocation | | | |
| 285 | DestCircle | RELATE | Parent_Circle | DestNodal | | | |
| 286 | OutOpType | MATCH | NumberingLevel | CalledMSISDN | I | | |
| 287 | OutOperatorType | RELATE | OutOperType | OutOpType | | | |
| 288 | OutOperatorName | RELATE | OperNames | OutOpType | | | |
| 289 | | IF | | 296 | 290 | | |
| 290 | CallType | SET | Constant | 'LOCAL' | | | |
| 291 | IaorIe | MATCH | TypeOfCall | 'A' | E | | |
| 292 | CallDuration | SET | Constant | '60' | | | |
| 293 | LocalChargeClassSMS | RELATE | OutChargClassSMSLoc | InOperatorType | OutOperatorType | IaorIe | RTP |
| 294 | CallCharge | RATE | LocalChargeClassSMS | CallStartTime | CallDuration | CALL_START_TRH.Value | |
| 295 | | STOP | | | | | |
| 296 | CallType | SET | Constant | 'STD' | | | |
| 297 | IaorIe | MATCH | TypeOfCall | 'E' | E | | |

Rated Record

| Field Name | Position | Format Type | Type | Default Value | Description | Attribute Code | Type Relationship | Entity |
|---|---|---|---|---|---|---|---|---|
| InterconnectFlag | 38 | %s | D | | | | | |
| INVoucherId | 45 | %s | D | | | | | |
| N_IMEI | 4 | %s | K | | | | | |
| OwnerCaller_VVC | 33 | %s | K | | OwnerCaller for Velocity Check | | | BASE_O |
| JulianEventDateTime | 24 | %s | K | | | | | VCC_DA |
| IN_AmountBalance | 43 | %s | D | | | | | |
| Home_Circle | 51 | %s | D | | | | | |
| N_GPRS_Dlink_Uplink | 54 | %s | D | | | | | |
| Location | 29 | %s | D | | Location for Velocity Check | | | |
| VCC_Flag | 31 | %s | D | | Event Flag for Velocity Check | | | VCC_FLA |

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New Modify Remove

## (g) Groups Management

This function enables User Groups to be defined, and to carry out checks on the groups by assigning rules to each one according to each one's particular features.

The following table shows a brief description of group parameters.

| Field Name | Description |
|---|---|
| Group name | Defines the symbolic name of the group, this name is available in the information associated to the notification as detail;1. |
| Description | Allows brief description of group. |
| Priority | Defines verification order of assignations within same group. |
| Rule | Defines User Group automatic assignation rules for the lines identified by the traffic, based on general features (zone of origin, origin source). |

User Classes Management

| Priority | User Class | Rule | Description | VerifyAllPatterns | SignalTraceActive |
|---|---|---|---|---|---|
| 1 | MobileCaller_PostPaid | 1=1 | Post Paid Customers | Y | Y |
| 1 | MobileCaller_Prepaid | 1=1 | Prepaid Customer | Y | Y |
| 1 | Unknown_Cat_Customer | 1=1 | Other Category Moblie Caller | Y | Y |

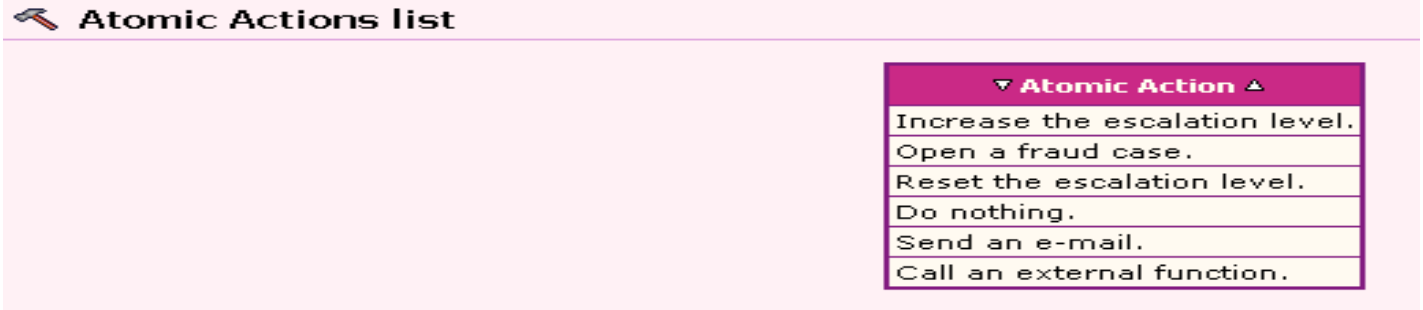
New Modify Rules Delete

## (h) Actions management

Through this function the Actions to be carried out in the event of fraud alerts are defined. Each alarm's escalation level is linked to Boolean rules that manage and activate it, in growing priority order. The Management of Alarms includes the implementation of one of the following groups of atomic actions-

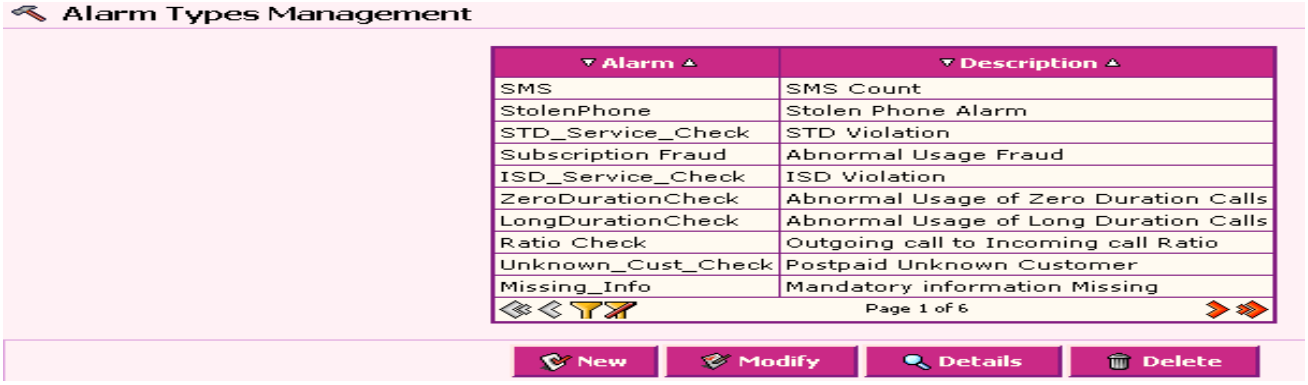
- Escalate; Increment of the escalation level associated with a user for the specific notification.
- Notify; Opens a fraud case, which the operator might have to work on.
- Reset Escalate; Zero; sets the escalation level associated with the user for the specific notification.

- Send Email; Sends specific emails with notification data to configurable recipients.
- External Call; The system provides a dossier of notification data to any external configurable procedures
- No Operation




The following table shows, for each available field, the field name, whether it is required, and a brief description of its function.

| Field Name | Description |
|---|---|
| Alarm | Type of alarm, in priority order. |
| Priority | Defines action verification order within same group. |
| Escalation | Level attributed to each set of actions, to enable system to select appropriate set of elementary actions to carry out, given same conditions. |
| Group | Defines Action's group of belonging. |
| Rule | SQL-like language Boolean expression which, if verified, determines the action to carry out for the group of belonging. |



Activation Rules Management

| Alarm | Escalation | Priority | Action Group | Rule |
|---|---|---|---|---|
| BLK_CalledNo | 0 | 34 | FirstSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |
| BLK_CalledNo | 1 | 35 | SubsequentSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |
| CallFwd | 0 | 30 | FirstSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |
| CallFwd | 1 | 31 | SubsequentSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |
| Call_Callision_Alarm | 0 | 39 | FirstSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |
| Call_Callision_Alarm | 1 | 40 | SubsequentSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |
| DeactivatedCust | 0 | 10 | FirstSignalManagement | (NOT (In_List('White',CALL.N_CallingNo,to_number (CALL.JulianEventDateTime),'CallNumber','WHT_SPC_CALLING_ AND (NOT (In_List('White',CALL.N_CalledNo,to_number (CALL.JulianEventDateTime),'CalledNumber','WHT_SPC_CALLED_ |

## (i) Work lists

iRevenue Assure allows setting up work lists, to manage the fraud cases generated by the system ; can be viewed and defined.

The following table shows a brief description of each parameter of a work list.

| Field Name | Description |
|---|---|
| Name | Defines the name of a Worklist. |
| Variables | Allows variables from a defined list to be inserted. |
| Alarms | Allows alarms from a defined list to be inserted. |
| Rule | Allows a rule from a defined list to be inserted. |
| Priority | Allows a priority from a defined list to be inserted. |
| Operators | Allows an operator from a defined list to be inserted. |

Work Lists Management

| Name | Priority | Rule | Description |
|---|---|---|---|
| WKL_BR_EAS | 1 | ((substr(CALL.R_SwtichName,5,3)='EAS') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='BR') | Bihar-East |
| WKL_KO_EAS | 2 | ((substr(CALL.R_SwtichName,5,3)='EAS') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='KO') | Kolkatta-East |
| WKL_WB_EAS | 3 | ((substr(CALL.R_SwtichName,5,3)='EAS') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='WB') | WestBengal-East |
| WKL_OR_EAS | 4 | ((substr(CALL.R_SwtichName,5,3)='EAS') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='OR') | Orissa-East |
| WKL_AS_EAS | 5 | ((substr(CALL.R_SwtichName,5,3)='EAS') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='AS') | Assam-East |
| WKL_NE_EAS | 6 | ((substr(CALL.R_SwtichName,5,3)='EAS') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='NE') | NorthEast-East |
| WKL_AP_SOU | 7 | ((substr(CALL.R_SwtichName,5,3)='SOU') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='AP') | AndhraPradesh-South |
| WKL_KT_SOU | 8 | ((substr(CALL.R_SwtichName,5,3)='SOU') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='KT') | Karnataka-South |
| WKL_KL_SOU | 9 | ((substr(CALL.R_SwtichName,5,3)='SOU') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='KL') | Kerala-South |
| WKL_CH_SOU | 10 | ((substr(CALL.R_SwtichName,5,3)='SOU') OR (substr(CALL.R_SwtichName,5,3)='INT')) AND (CALL.Origin_Circle='CH') | Chennai-South |

Page 1 of 4

New Modify Users Delete

## (i) Case Management Workflow Module

Case Management Workflow Module offers a complete web-based interface to the analyst team in charge to verify and investigate fraud cases generated. It is possible (as in all Modula GUI's) to set up specific user profiles associating to the profiles single features within the product and associate users to user profiles (user and profiles structure can be synchronized with the centralized access authorization system).

This flexibility allows to perfectly tailoring Case Workflow structure to carrier organization and to fraud analysts team composition.

Generated cases are taken by analysts offering them powerful and performance data traffic search engine with multiple search key support, black list access along with a complete work list (queues) support that allows each analyst to correctly manage the history of his cases assigning severity level of fraud case and tracking the case life through its different steps, escalate if needed, overriding alarms.

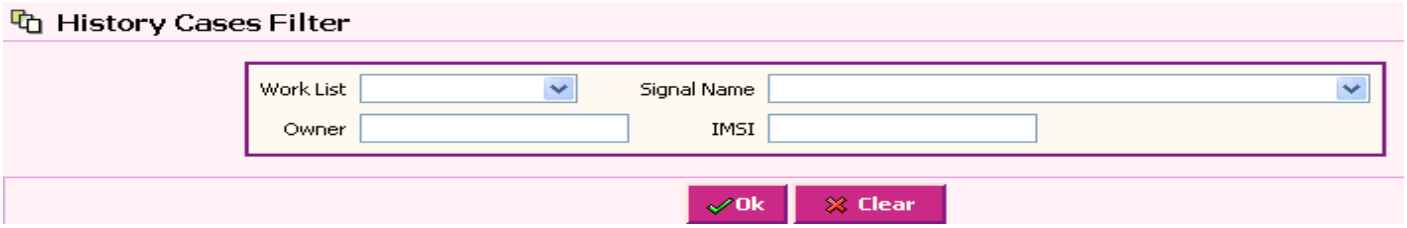
Through an alarm interface it is also configurable to trigger alarms when severity level is exceeded through electronic devices to selected users.

It is also possible to establish escalation procedures based on case severity and automatically assign cases to fraud analysts based on various criteria (e.g. market, type of case, type of customer, fraud analyst experience level) as well as adding resolution descriptions once cases are closed.

Case management workflows allows to collect cases in "dossiers", improving operator's capability in relate cases basing on case similarity, and managing a set of them as a unique object, the dossier.

Via case management GUI operators can track cases/dossiers, taking actions such as additional payments, service barring etc., marking the dossier for follow-up.

The capability of the system to define work lists for operators, automatically assigning cases to a specific work list depending on case characteristics, allows to efficiently subdividing workload on operators basing also on operator's skills (e.g. international fraud operators, national frauds operators, etc.).




## Reconciliation module Benefits

Following are some of the main benefits of Reconciliation module-

- Automatically connects the authorized server and downloads relevant data to the application server.
- The Reconciliation rules can be formulated for both the data parameters to be reconciled.
- Provides the Prepaid discrepancy report by reconciling data from IN & MSC and mapping the same to the pricing plans thus, detecting any fraud in Prepaid segment
- Provides the SMS discrepancy report by reconciling data from MSC and SMSC and helps in arresting any revenue leakage in the SMS services.
- Efficient variant data management.
- Improved revenue stream by minimization of losses due to fraud at source level.
- Improved operational efficiency and minimization of administration overhead.
- Enhances fraud and revenue leakage analysis helping in better decision support.

### Reconciliation Process

RA process involves a series of configuration to be carried out in a sequence to arrive at the required analysis reports and to pin point the exact revenue leakages.

This section highlights the required configuration in a stepwise manner. Following are the configuration and the execution sequence for Reconciliation process,

- Configuration of Entity and Entity Item Values.
- Configuration of DataSet-1 and DataSet-2
- Generation of Reconciliation ID, with required parameter details.
- Configuration of data input source and table space requirement.
- Fetch the required data from Input Sources.
- Creation of Required database table space for input data sources.
- Loading of input data sources into database tables.
- Configuration of Reconciliation rules for each fields identified for reconciliation process.
- Identify duplicates and eliminate them from reconciliation process.
- Execution of reconciliation process.
- Generation of reports.

From the reports identify the matched and unmatched data to identify the revenue leakage.

Reconciliation module can be used for comparison of any two data sets. Following is the main screen of the Reconciliation module highlighting the different submodules available in Reconciliation module.


**Reconciliation module Report Screen**

### Configuration of Entity

This section highlights the configuration of entity and entity values, which is an important part of initial configuration of the product for Reconciliation process. There are two part of for entity configuration first one is the configuration of entity and the second part is the configuration of the entity value items. Entity is the dataset configuration name; entity value items store the details of the fields available for the entity against which it is configured.

Following diagram represent a set of entity configured,

| Entity Name | Description |
|---|---|
| AIRTEL_CDRS_FIELDS | Airtel cdr fields |
| Airtel_fields | Cdr fields of airtel |
| IDEA | IDEA FIELDS |
| MEWSD | MEWSD CDRS |
| MTNL_CDRS_FIELDS | Mtnl_cdrs fields |
| MTNL_MUB | mumbai data |
| MTNL_Ope | MTNL_Ope |
| Mtnl | mtnl fields |
| Mtnl_fields | cdrs fields of MTNL |
| OPERATOR | OUR OPERATORS NAME |

Page 1 of 2

New | Modify | Entity Items | Details | Delete | Back

**Reconciliation module Entity Screen**

The following diagram represents the configuration of entity value items configured for entity 'MTNL_CDRS_FIELDS',

| Entity Name | Entity Item Value |
|---|---|
| MTNL_CDRS_FIELDS | CALLEDNOB |
| MTNL_CDRS_FIELDS | CALLINGNOB |
| MTNL_CDRS_FIELDS | DATEB |
| MTNL_CDRS_FIELDS | DUPMARKB |
| MTNL_CDRS_FIELDS | DURATIONB |
| MTNL_CDRS_FIELDS | TIMEB |
| MTNL_CDRS_FIELDS | TIMESTAMPB |
| MTNL_CDRS_FIELDS | VALUE10B |
| MTNL_CDRS_FIELDS | VALUE11B |
| MTNL_CDRS_FIELDS | VALUE12B |

Page 1 of 2

New | Modify | Details | Delete | Back

**Reconciliation module Entity Items Screen**

Entity and Entity item values can also be used for configuration and identification of Dataset- 1 and Dataset-2 as well.

### Reconciliation rules configuration

Whenever a two dataset is compared the information stored in one source can be different from the format of the same information stored in other system. This adds to the complexity of the reconciliation process. Reconciliation module resolves this problem with a flexible rule configuration which is used to reformat the fields to bring them to a acceptable same format so that information can be directly compared with other system information. During Reconciliation process calling number, called number can be available in RAW CDRs in a different format than that of rated CDRs; date format in RAW CDRs can be different than that of in rated CDR.

Reconciliation module reconciliation rules can be of difference between two values, SQL normalization rules for a field. SQL normalization rules can be as complex as possible giving highly flexible rule definition.

Following screen depicts a reconciliation rule configured for a interconnect dispute resolution reconciliation process where in time difference for duration can be 3 seconds, for timestamp can be 50 seconds and this CDR should be identified as duplicate and both the calling and called numbers are normalized to arrive a common format,

Reconciliation > Reconcile Rules > Configure Rules

Reconciliation ID : MTNL-AIRTEL-1006-JUN07-JUN07

DATASET-1

| | Column Name | Reconcile Rule |
|---|---|---|
| ☐ | DURATIONB | 3 |
| ☐ | DUPMARKB | N |
| ☐ | CALLEDNOB | decode(substr(ltrim(trim('f' from trim(' ' from callednob)),'0'),1,2),'91',substr(ltrim(trim('f' from trim(' ' from callednol |
| ☐ | CALLINGNOB | decode(substr(ltrim(trim('f' from trim(' ' from callingnob)),'0'),1,2),'91',substr(ltrim(trim('f' from trim(' ' from callingnc |
| ☐ | TIMESTAMPB | 50 |

DATASET-2

| | Column Name | Reconcile Rule |
|---|---|---|
| ☐ | DURATIONA | 3 |
| ☐ | DUPMARKA | N |
| ☐ | CALLEDNOA | decode(substr(ltrim(trim('f' from trim(' ' from callednoa)),'0'),1,2),'91',substr(ltrim(trim('f' from trim(' ' from callednoa |
| ☐ | CALLINGNOA | decode(substr(ltrim(trim('f' from trim(' ' from callingnoa)),'0'),1,2),'91',substr(ltrim(trim('f' from trim(' ' from callingnc |
| ☐ | TIMESTAMPA | 50 |

**Reconciliation module Configuration Rules Screen**

### Reconciliation Execution process

This section highlights the different steps involved in the execution of the reconciliation process from fetching of files from different input sources, loading of the data into DB table space, marking a duplicate and removing the duplicate records from the comparison process and finally the reconciliation initiation.

When configuration reconciliation ID user should configure the input source where from RAW CDRs and the rated CDRs with server credentials details should be configured for Reconciliation. Using Fetch Data functionality for Reconciliation process data can be acquired from the two input sources, so both the data RAW CDRs and Rated CDRs are made available for Reconciliation module. Following screen shot of Reconciliation module depicts the typical way of fetching the data from the remote servers.

From Remote Server

Reconciliation ID : MTNL-AIRTEL-1006-JUN07-JUN07

1006
manish/Recon/Delhi/EXTRACTED_CDRS_AIRTEL/Recon/TEST/TEMP1/OPERATOR

Server Name : server8
Download Path : /Data/manish/Recon/Delhi/EXTRACTED_CDRS_AIRTEL/Recon/TEST/TEMP1/operoup

Fetch

Mtnl_01.csv.Timestamp.csv
Mtnl_02.csv.Timestamp.csv
Mtnl_03.csv.Timestamp.csv
Mtnl_04.csv.Timestamp.csv
Mtnl_05.csv.Timestamp.csv

_1006
manish/Recon/Delhi/EXTRACTED_CDRS_AIRTEL/Recon/TEST/TEMP1/OLO

Server Name : server8
Download Path : /Data/manish/Recon/Delhi/EXTRACTED_CDRS_AIRTEL/Recon/TEST/TEMP1/olooup

Fetch

Airtel_01.csv.Timestamp.csv
Airtel_02.csv.Timestamp.csv
Airtel_03.csv.Timestamp.csv
Airtel_04.csv.Timestamp.csv
Airtel_05.csv.Timestamp.csv

Back

**Reconciliation module Remote Server Screen**

Once the data is made available at the input folder of the Reconciliation module, data needs to be uploaded into the relevant tables in the designated DB tablespace. Using Data Loading functionality data from the input folder of Reconciliation module for a Reconciliation process reconciliation ID will be loaded. Data Loading is performed one step at a time first the input data from set1 which is RAW CDRs and second the Data from billing system Rated CDRs is loaded.

Following screen shows a typical result of loading process, errors if any while loading the data is highlighted at the Error Information section,

Run > Data Loading > ReconciliationID Selection

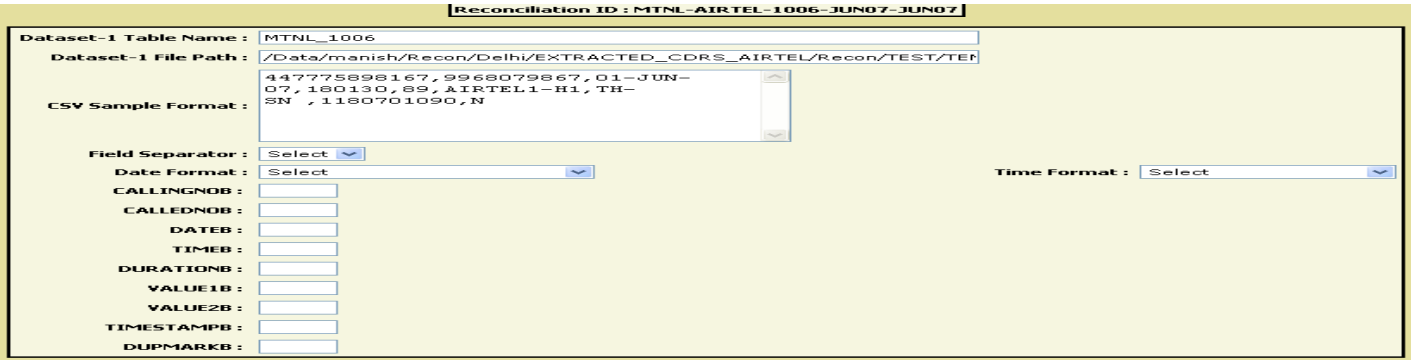
* Reconciliation ID : MTNL-AIRTEL-1006-JUN07-JUN07

Dataset-1 Dataset-2

Timestamp Load Clear Back

**Reconciliation module Reconciliation ID Selection Screen**

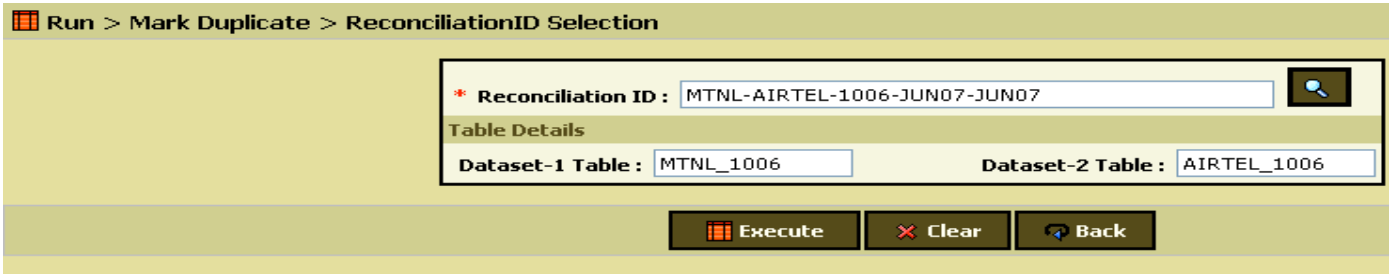
As part of Data Loading procedure user has to specify the format of date and time and most importantly the field separator for that particular input source. Reconciliation module provides all the available date and time formats and as well as possible field separator. For the convenience of user when user clicks on the button Timestamp following screen is displayed which also provides a sample of the first record available from the input data source for which loading operation is being performed.




### Reconciliation module Data Loading Screen

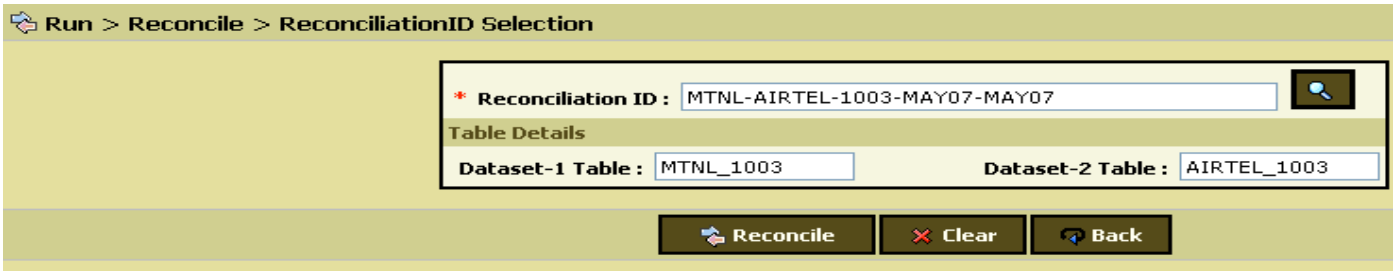
Date, Time and Field Separator can be selected from the drop down list.

The data from the billing system might contain some duplicates. In case a single call is to be charged for two different events their might be two different rated CDRs available. This results in complexity while comparison and might result in wrong results. To avoid duplicate data at input source level itself, Reconciliation module provides a facility to mark duplicate records and eliminate them from reconciliation process. Following screen highlights the Mark Duplicate facility available in Reconciliation module.




### Reconciliation module Duplicate Check Screen

The count of duplicates identified as part of Mark Duplicate process is available as part of reports. Next the most important part is reconciling process. Following screen highlights wherein a reconciliation ID can be selected and a reconcile process can be initiated,



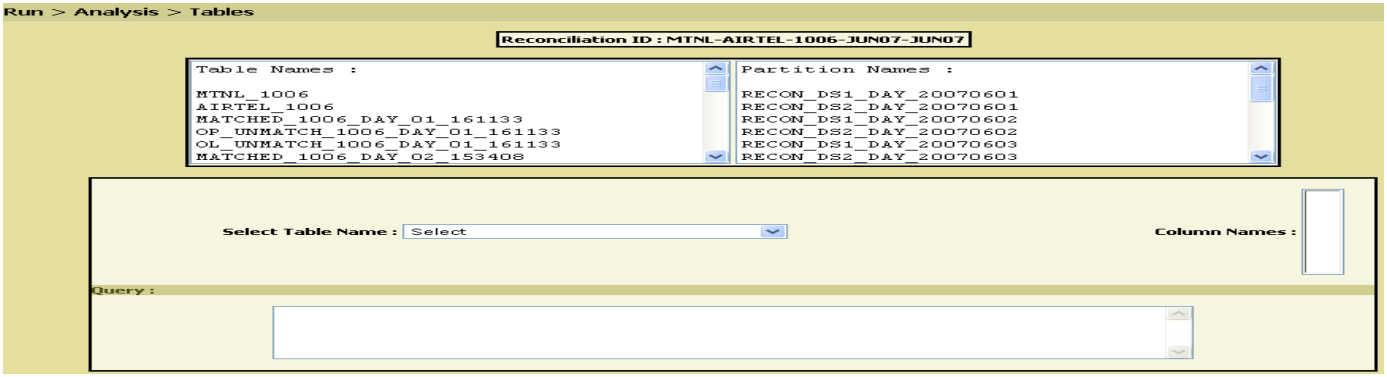

### Reconciliation module Reconciliation ID Selection Screen

The status of Reconciliation process for a particular date as part of the configuration can be checked in Reconciliation module using the Reconcile status facility. Reconcile status provides detailed information of total CDRs at both input source side, total matched CDRs from both sides and total unmatched CDRs. It is important to note that data for Reconciliation process is enormous and per day CDRs can be up to millions

and tens of millions depending on the customer base and CDRs generated per day per customers to optimize the reconciliation process Reconciliation module uses the partitioning facility available in Oracle. At the time of creating of DB Table space user can decide to either create normal tables or create with Partitioning facility all this is functionality is configurable from the GUI.

Reconcile process creates 4 new tables which are matched dataset for each input sources and unmatched dataset for each input sources. The matched dataset can be further used to validate the process and rules configured. The Unmatched dataset can be further analyzed for discrepancy between the two systems in case of Reconciliation process it can be identified which records from RAW CDRs are not rated at the billing system. Reconciliation module provides a analysis facility where user can select the tables from the reconcile process and select the appropriate fields required which gets listed on the GUI for further analysis.

Following screen displays the results analysis facility wherein user is allowed to select the source and the resultant tables where in matched, unmatched data is stored. Once the table is selected the relevant fields can also be selected for analysis,




**Reconciliation module Reconciliation Analysis Screen**

As part of archiving process the unmatched data can be extracted in the required format or a DB dump of unmatched table can be stored for future reference. In the above screen when the data is partitioned user can also select the partition for which one wants to analyze the data.

### Reconciliation Reports

Reports are available at the GUI as well as a PDF report format. The GUI report available provides details of source, matched, unmatched and duplicate record count. If the table is partitioned day wise then day; wise breakup of the matched, unmatched and duplicate records is available at a single place.

Following is the typical report available in the Reconciliation module GUI,

Run > View Report > Partition

Reconciliation ID : MTNL-AIRTEL-1006-JUN07-JUN07

| Partition Name | Table Name | Total Count | Matched Count | Unmatched Count | Duplicate Count |
|---|---|---|---|---|---|
| RECON_DS1_DAY_20070601 | MTNL_1006 | 3442 | 3400 | 42 | 0 |
| RECON_DS1_DAY_20070602 | MTNL_1006 | 3216 | 3200 | 16 | 0 |
| RECON_DS1_DAY_20070604 | MTNL_1006 | 3416 | 3377 | 14 | 25 |
| RECON_DS1_DAY_20070605 | MTNL_1006 | 3403 | 3377 | 26 | 0 |
| RECON_DS1_DAY_20070606 | MTNL_1006 | 3391 | 3356 | 35 | 0 |
| RECON_DS1_DAY_20070607 | MTNL_1006 | 3427 | 3408 | 19 | 0 |
| RECON_DS1_DAY_20070608 | MTNL_1006 | 3318 | 3297 | 21 | 0 |
| RECON_DS1_DAY_20070609 | MTNL_1006 | 3119 | 3110 | 9 | 0 |
| RECON_DS1_DAY_20070610 | MTNL_1006 | 2171 | 2171 | 0 | 0 |
| RECON_DS2_DAY_20070601 | AIRTEL_1006 | 3401 | 3400 | 1 | 0 |
| RECON_DS2_DAY_20070602 | AIRTEL_1006 | 3200 | 3200 | 0 | 0 |
| RECON_DS2_DAY_20070604 | AIRTEL_1006 | 3388 | 3377 | 1 | 10 |
| RECON_DS2_DAY_20070605 | AIRTEL_1006 | 3383 | 3377 | 1 | 5 |
| RECON_DS2_DAY_20070606 | AIRTEL_1006 | 3359 | 3356 | 3 | 0 |
| RECON_DS2_DAY_20070607 | AIRTEL_1006 | 3411 | 3408 | 3 | 0 |
| RECON_DS2_DAY_20070608 | AIRTEL_1006 | 3298 | 3297 | 1 | 0 |
| RECON_DS2_DAY_20070609 | AIRTEL_1006 | 3110 | 3110 | 0 | 0 |
| RECON_DS2_DAY_20070610 | AIRTEL_1006 | 2171 | 2171 | 0 | 0 |

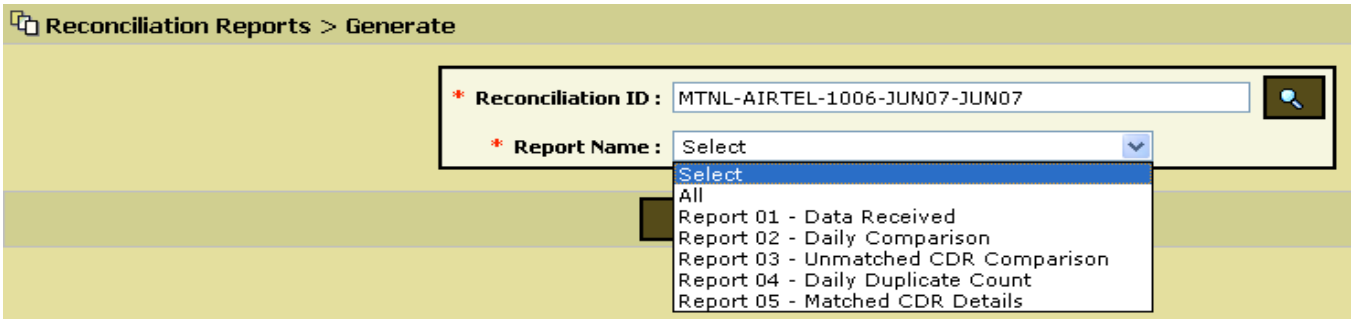
| Table Name | Total Count | Matched Count | Unmatched Count | Duplicate Count |
|---|---|---|---|---|
| MTNL_1006 | 28903 | 28696 | 182 | 25 |
| AIRTEL_1006 | 28721 | 28696 | 10 | 15 |

**Reconciliation module Reconciliation Report Screen**

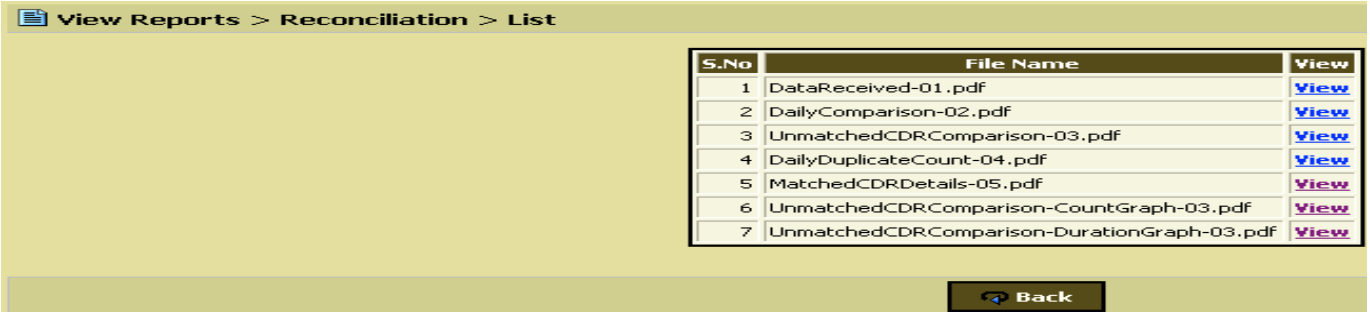
PDF report facility available can be used to generate and store reports in a PDF file for easy reference. These reports are user initiated user can select from the available set reports or select all at the same time to be generated. A graphical representation of the variance reports is also available to user for better representation of reconciliation process result analysis. Once generated these reports are stored in a particular directory in the system. User can as well view them using GUI facility and save them on their local PC for reference.

Following screen depicts the PDF file report generation facility available in Reconciliation module,




**Reconciliation module Reconciliation Report Generation Screen**

Once the reports are generated user can view them using GUI view reports facility by selecting the appropriate reconciliation ID, following screen depicts this functionality,




**Reconciliation module Reconciliation Summary Report Screen**

Reports highlighted here are the standard reports available as part of Reconciliation module product, specific reports as per the requirements of the RA process and the operator can be provided.

Report "Data Received; 01.pdf" provides details of data received by both input sources, number of records and duration day-wise.

Report "Daily Comparison;02.pdf" provides details of daily comparison of data from both input sources total no. of records and duration, difference and the variance in percentage.

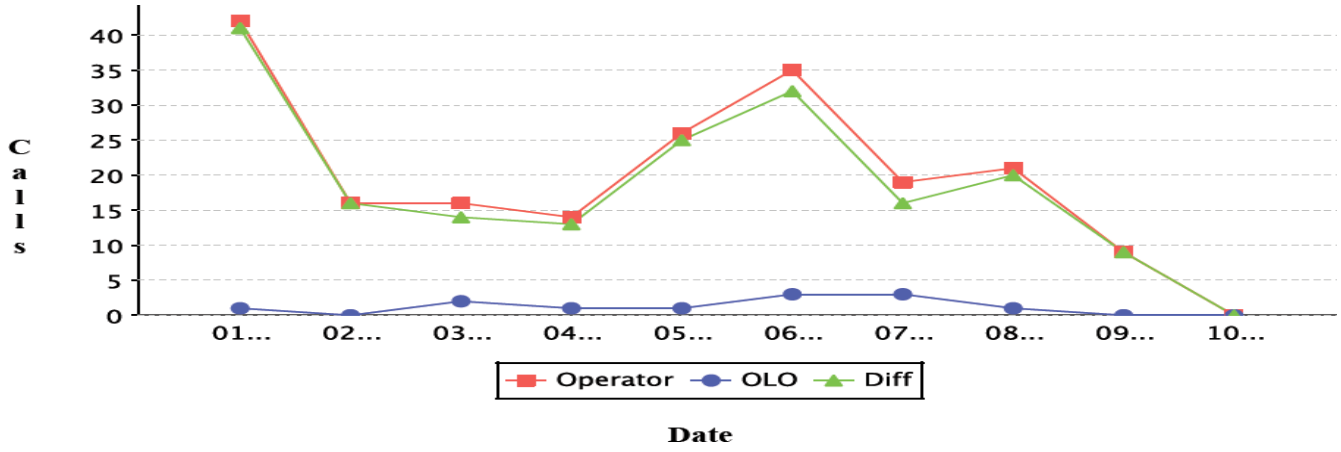
Report "UnmatedCDRComparison;03.pdf" provides details of total unmatched records and duration value day-wise from both input sources.

Report "DailyDuplicateCount;04.pdf" provides details of duplicate records identified from both input sources on a daily basis.

Report "MatchedCDRDetails;05.pdf" provides details of total matched records and duration value day;wise from both input sources.

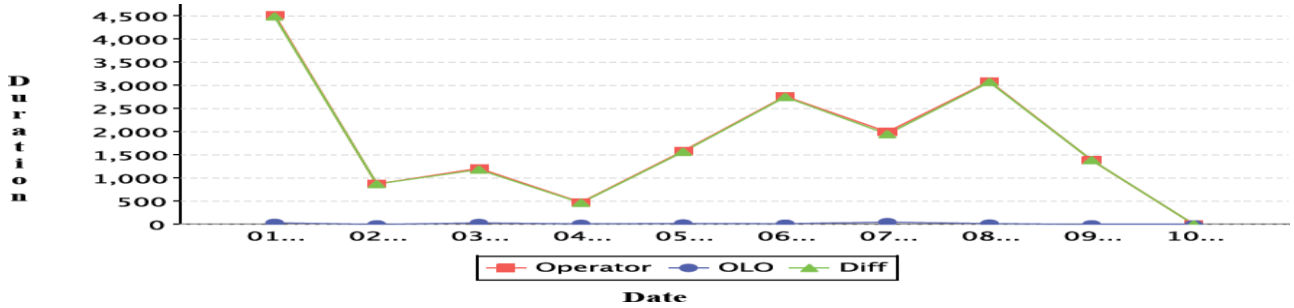
Report "UnmatchedCDRComparison;CountGraph;03.pdf" provides a graphical representation of the variance of unmatched data (records) from both input sources. Following is the example of a graphical representation of this report,




**Reconciliation module Graphical Report Screen**

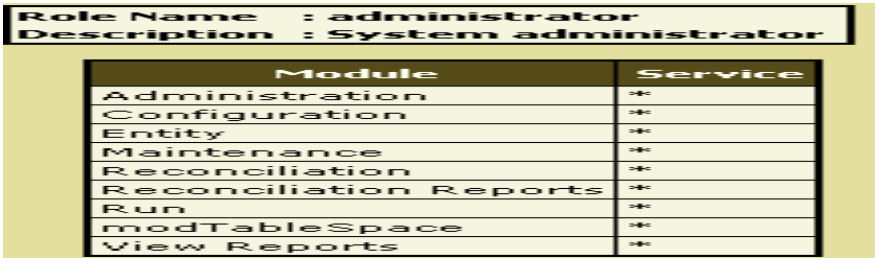
Report "UnmatchedCDRComparison;DurationGraph;03.pdf" provides a graphical representation of the variance of unmatched data in terms of duration value day wise from both input sources. Following is example of a graphical representation of this report,




**Reconciliation module Graphical Report Screen**

As mentioned these are the typical reports that Reconciliation module provides based on the requirement of operator. RA specific reports requirements can be addressed as part of implementation.

Reconciliation module provides a comprehensive user management facility using which different users can be created with a good control over access rights. Read, write or No access permission can be configured as per the requirement when a user is created. Following screen highlights typical administrator user permissions.



Role Name : administrator
Description : System administrator

| Module | Service |
|---|---|
| Administration | * |
| Configuration | * |
| Entity | * |
| Maintenance | * |
| Reconciliation | * |
| Reconciliation Reports | * |
| Run | * |
| modTableSpace | * |
| View Reports | * |

**Reconciliation module Admin Control Screen**

## iRevenue Assure REPORTS

iRevenue Assure provides a set of in-built reports and any deviation or additional reporting requirements can beadhered; to through configurations.

All the reports can be generated on demand or through in-built scheduler.

**Standard Traffic Data**

- Mediation Traffic – CDR count by # records and # minutes reporting on input viz., records in switch native format and output to the downstream revenue generation applications viz., retail billing and interconnect billing applications
- Mediation Traffic Summary Report – Summarization of traffic report by day/week/month overall and switch wise
- Filtration, Error and Normalization Report – Reporting on the number of records filtered, sent to error and normalized by switch / date
- Duplication Check Report – Reporting on the number of records sent to duplicate by switch /date

**Mediation Processing Detail**

- Filtering Detail Report – Detailed report of the records filtered by switch, date, time
- Error Detail Report – Detailed report of the records placed into error file and reasons by switch, date, time and error reason
- Normalization Detail Report – Detailed report of the records normalized by switch, date, time and record type

**Mediation Pattern and Trend**

These reports provide a historical view of the variation in totals on a daily, weekly, and monthly basis by switch, day of week, time of day and day of year (seasonal view). Summary trend reports allow the revenue assurance investigator to identify situations where significant variances in trends might indicate underlying problems with switches, reference tables, business policies or other causes.

**Mediation Assurance**

- Data Collection Reports – Periodicity and details of the data collected from each of the network element
- Time Gap Analysis Reports – Configurable Time Gap analysis reports between CDR to CDR based on the Switch type and Time Period (peak and off peak)
- File Continuity Reports – Configurable continuity of records between the files collected from the same switch
- Report of total number of CDRs at network elements to be generated and this to be reconciled with mediation input CDRs for all LOBs, which are CDR based. Discrepancy/error report to be generated on daily basis or on intervals to be specified by the RA unit
- Proof of tapping CCS7 signaling for 1st level of RA i.e., reconciliation of calls generated in network and CDRs generated
- Report on the total number and duration of rejected records.
- CDRs in mediation which are discarded to be generated at each location on a daily basis or interval specified based on mediation input and output CDR reconciliation
- Threshold/acceptable limit for above to be specified and alarm to be generated to RA team whenever threshold has exceeded.
- Reports on mediation output based on call type – element wise i.e., roaming, and retail billing to compare with CDRs billed. Billed CDRs vs. Mediation CDRs

**CDR Processing**

- Processing – Batch CDR count by # records and # minutes reporting on input and output to bill cycle by batch, date, time, bill cycle
- Billing Summary Report – Summarization of processing reports by day/week/month overall and by bill cycle.

- Billing Discard and Error File Management Reports
- Billing Discard; Detailed Discard Reports – Reporting on the number of records discarded, by batch, date, time and reason
- Billing Discard Summary Report – Summarization of suspense and error reports by day/week/month and overall
- Billing Discard Aging Report – Report detailing the relative age of different groups of discarded records by switch, suspense type and age
- RA report on reconciliation of input CDRs to billing vs. actually billed CDRs
- Provision is required for reconciliation of CDRs recorded in the exchange and billed calls as per Bill Summary
- Provision is required for reconciliation of the total no. of subscribers (i) Registered and active at CRM, (ii) Working as per exchange/HLR and (iii) Actual billed
- Report of number of calls (CDRs) of all types including SMS, GPRS etc. in other categories, which are not rated and cross verification of these numbers with the status in CRM/provisioning systems
- Exception report on any premium rate CDRs or CDRs of services barred in respect of categories defined viz., SMS, GPRS etc. to be generated to plug leakage of revenue
- CDRs generated but not billed to be reported for accrued revenue

**Rating Management**

- Rating Tables Audit Log Report – This report collects detailed information from the audit log of the billing system on the changes made to the rating information.
- Customer Plans Audit Log Report – This report collects detailed information from the audit log of the billing system on the changes made to the customer privilege information
- Customer Plans vs. Provisioning Logs Reconciliation Report – This report reconciles the customer data changed in the billing system against the service provisioning logs for the changes during a specific period
- Revenue pattern analysis and projections including traffic and revenue generated under different tariff plans to rate the success of a plan launched
- Traffic pattern analysis on various routes, under different plans, services etc.
- Report on number of subscribers under different tariff plans for different services as per CRM and as per billing system to be generated on a monthly basis or at interval to be specified
- Business rules relating to the period beyond which an event is not to be billed is to be specified by the operator. For example, can a bill be raised for a call, SMS, etc. which were made more than 3 months ago or infrastructure charges or roaming charges for period more than 3 or 6 months. Regulatory guidelines also are to be considered. Report of such billing beyond the period specified to be generated
- In case of Non CDR billable items the unbilled portion shall be reported

**Customer Care Reports**

- Report of different types of complaints logged/received from subscribers categorized as technical/fault, billing related, provisioning related etc. and pending issues report on monthly basis.
- Report of clearance of such cases based on time taken by categorizing the time taken for clearance into same day, less than 7 days, 7;15 days, 16days to one month, more than 1 month but less than 60 days, more than 60 days etc
- Calculation of loss of revenue due to fault – monthly basis or at intervals to be specified
- No. of surrenders /loss of subscribers and resulting loss of revenue
- Classification and consolidation of reasons for customers leaving the network
- Provision for documentation of the action taken against each alert/alarm and tracking of escalation to be made in the system.

**Billing Cycle Timing, Trending & Ageing**

- Keeping track of the overall timing and performance of bill cycle management is an important part of revenue assurance. If the bill cycles are running late, there can be direct revenue impacts. Even more importantly, keeping track of the history of the totals over individual bill cycles can provide the investigator with clues as to the presence of other problems.
- Bill Cycle History Report – Showing the run dates, full cycle processing times, run times and totals of bill cycles over time.
- Billing Summary Trend Analysis – These reports provide a historical view of the variation in totals on a bill cycle, daily, weekly, and monthly basis by bill cycle, day of week, time of day and day of year (seasonal view). Summary trend reports allow the revenue assurance investigator to identity situations where significant variances in trends might indicate underlying problems with bill cycles, reference tables, business policies or other causes.
- RA system also to do random checks of specified number of bills for each of the services offered and documented.

**IAA CDR Processing**

- Interconnect Processing Report – Batch CDR count by # records and # minutes reporting on input and output trace ability
- Interconnect Summary Report – Summarization of processing summary report by day/week/month overall and by Carrier and Interconnect Period
- In the case of roaming, RA report on reconciliation between mediated CDRs vs. priced CDRs
- In the case of interconnect billing, RA report on reconciliation of mediation vs. CDRs of interconnect
- RA report on TAP IN CDRs vs. retail billing CDRs of roaming
- RA report on reconciliation of pricing CDRs vs. TAP CDRs
- RA report on reconciliation between tap out CDRs and invoice generated by multiple clearing houses to detect leakage of revenue.

**InterFcarrier / Roaming Traffic Pattern and Trend Analysis**

- Carrier Invoicing Summary Trend Analysis – These reports provide a historical view of the variation in totals on a carrier, daily, weekly, and monthly basis by carrier, Interconnect period, day of week, time of day and day of year (seasonal view). Summary trend reports allow the revenue assurance investigator to identify situations where significant variances in trends might indicate underlying problems with carrier relationships, reference tables, business policies or other causes.
- RA reports through interface with Interconnect billing on the amount disputed by other operators and amount disputed by operator – for management information on revenue implications
- Provision for audit of rate matrix applications in the case of Interconnect billing by selecting at random any month/months in a quarter or year for different categories like local, NLD and ILD
- In case of MOU partners, the discounts allowed as per business rules and what is actually given in the bills – report of discrepancies party wise

**Prepaid SIM Analysis**

- SIM Creation Tracking Reports – Reports that tell us when and how many SIM cards were ordered, created and received by the service provider, and when
- SIM Provisioning Reports – Reconciliation reports showing when each received SIM card has been successfully pre-provisioned across the network
- SIM Distribution Reports – Logistics report highlighting which SIM cards have been sent through which distribution channel and when
- SIM Collections Reports – Report showing the revenues collected against invoices for SIMs distributed
- SIM Aging Reports – Reports showing the collections of aging SIM invoices by geography, distributor and date.
- Number of SIM cards along with mobile numbers, which were re-issued on account of damage/fault

**Voucher System Analysis**

- VOUCHER Creation Tracking Reports – Reports that tell us when and how many VOUCHER cards were ordered, created and received by the service provider, and when
- VOUCHER Provisioning Reports – Reconciliation report showing when each received VOUCHER card has been successfully pre-provisioned across the network
- VOUCHER Distribution Reports – Logistics reports highlighting which VOUCHER cards have been sent through which distribution channel and when
- VOUCHER Collection Reports – Reports showing the revenues collected against invoices for Voucher's distributed
- VOUCHER Collections Aging Reports – Reports showing the collections for aging VOUCHER invoices by geography, distributor and date
- VOUCHER Usage Aging Reports – Reports showing the aging vouchers (from when they are delivered to the distributor until they are used by the customer).
- Voucher CDRs vs. Inventory of vouchers to check overcharging fraud

Voucher Management Database Snapshot Report – This is a report that tells the investigator the phone numbers and current balance for all customers in the voucher management system. Including the inventory associated with serial numbers and not yet activated to a customer

Whenever the balance of a pre-paid subscriber is increased there should be a corresponding voucher. And from here, a RA report on numbers whose balance has increased but no voucher has been generated or voucher is of lower denomination. This will identify discount cases also

**Usage Management**

The basic principle behind prepaid usage management reports is to reconcile the activity of the voucher management system against that reported by the network itself (via Mediation). In most cases, either the account by account reconciliation or the group by group summary level reconciliation is the only way to validate that usage is being managed and reported accurately. Prepaid MI/MO reports – comparing minutes tracked and output from mediation, vs. those input and output from the IN management system. In the case of prepaid subscribers, RA report on GGSN/SGSN + SMSC+MSC CDRs vs. IN CDRs Report on prepaid Tapping CDRs vs. prepaid out roamer CDR at IN.

These reports provide an overall activity reconciliation between the Voucher Management System and CDR Reports – In this report, the overall total of all prepaid activity, as reported by the IN management system, is compared to the corresponding report as reported by mediation. If these numbers match, means that 100% of the prepaid traffic registered by mediation is being captured and decremented by the IN.

**Subscription Analysis**

- Subscriber reconciliation reports – Subscriber reconciliation reports validate that all Subscribers listed in CRM, Sales, Activation and Billing systems all match with corresponding values in other system based upon the identity of the Subscriber. Many times, Subscribers will show different statuses, different rate plans, different options and different amounts due, based upon time and value synchronization problems between or within systems. These reconciliation reports validate the integrity of the values and report on the places where discrepancies occur.
- No provision should be available in the system to create subscriber or facility at HLR directly without going through CRM. In case such an event takes place, immediate report to be generated and displayed in RA. If nil, a nil report to be generated on a monthly basis
- Tracking delay between a Subscriber's request for termination, upgradation, change in plan, request for new service or features and actual provisioning/activation which are causes of dispute and loss of revenue.
- Activation status on all N/W elements like HLR, VMSC, SMSC etc. should be determined

**Circuit Inventory Analysis**

- In the case of non CDR based services like leased circuits, several reports to ensure Revenue Assurance are required. Report of delay in provisioning, upgrading, suspension or termination of services beyond an acceptable period of say, 7 days (period to be decided) to be generated for different parameters like by customer name, by circuit type, by time interval to be specified etc. Report also to specify the point of delay in terms of the unit where the delay has occurred.
- In case of non CDR based services also a reconciliation report of the number of connections as well as subscribers

**Revenue Reconciliation**

- Report of amounts lying unlinked or unaccounted LOB wise/area wise along with ageing.
- Report of refund cases based on time taken for effecting refund including cases that took more than 60 days.
- Reconciliation report of billing/Sub ledger/General Ledger including sundry debtor reconciliation with trial balance.
- Revenue reconciliation between system generated figures and general ledger booked figures
- Deposit reconciliation between system generated figures and general ledger booked figures
- Report of disputed cases and amounts involved LOB wise/area wise along with ageing.
- Report of doubtful debts with customer details and realizations against such debts.
- Tracking of recovery of outstanding debts by recovery agents. Ageing of these recoveries with a view to check the correctness/accuracy of commission paid to them.
- Report of rebate given to subscribers for fault/deficiency in services including number of cases level wise/area wise/LOB wise.
- Report of delay/gap in billing cycle and bill printing.
- Report of inter operator settlements – Summary report on the trend of actual amounts invoiced vs. settled
- Outgoing revenue paid to ILDOs vs. revenue generated from ISD traffic POI wise
- Outgoing revenue paid to Nodes vs. revenue generated from STD traffic – POI wise.
- Service Tax reconciliation – Service Tax as per billing/sub ledger/credit adjustments/general ledger.
- Loyalty schemes – Bonus points being credited/ accumulated and encashment by subscribers.
- Report of waivers of different types of charges given to different categories of subscribers as per business rules and the actual amount involved on a monthly basis or at intervals to be specified

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