# Trusted Third Party-based CDR Management System

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*Abstract*—**Call Detail Records (CDRs) are computer generated records which contain details about the calls which pass through the operator's particular telephone switch. CDRs are stored for a particular period of time identified by company policy and country legislation. During their storage lifetime the CDRs are subjected to various kinds of analysis and mining procedures to enable the operator to obtain such factors which will help to serve the consumers in a better way and generate more revenue for the operator. Sometimes such procedures violate the privacy and security requirement of the consumer and the country legislation. This paper proposes a Trusted Third Party (TTP) based CDR Management System which can help the operators reduce regulatory burden and IT infrastructure requirements. TTP based CDR Management System stores several operators' CDRs, under contract, with a single entity which can analyse, mine and regulate the data on behalf of operators and government and provide better value to business.**

*Index Terms*—*Call Detail Records, security, telecommunication, trusted third party.*

## I. INTRODUCTION

Broadly, the CDRs can be categorized into three types; voice call CDR, SMS CDR and Data CDR. CDRs are generated automatically by computer systems each time the customer utilizes the telecom service. As CDRs contain the details about the service utilized, it can have at minimum the following field: type of service (voice, SMS, data), source number, destination number, time and date of call, duration of call. Basically all the CDRs are collected and most commonly analysed for billing purposes, but in recent years the analysis has grown more sophisticated. The CDR analyses have become an integral part of the telecom industry for obtaining better insight into user activities and provide customized services which in turn can help realize improved profits. In this paper we propose a Trusted Third Party (TTP) based CDR Management System which performs the CDR analyses and storage on part of the telecom operator at the same time satisfying all the legal requirements. The TTP employs better tools and techniques and provides results to the operator. The telecom operator takes the results and consults the findings for better decision making.

Competition in the telecom industry has greatly intensified propelled by saturation in the customer base. Telecom operators are facing stiff competition in terms of profits and Average Revenue per User (ARPU). Some companies have even discarded ARPU and moved to AMPU (Average Margin per User), but that is just one measure. Operators themselves are realizing the need of efficient data collection and mining techniques which can help them in improved decision making. There is no alternative to CDRs in data collection for telecom operators. The need remains of better mining and analysis technique which can paint a clearer picture for the operator. Also, CDR analyses and long term storage requires substantial investment. The focus is on to optimize or substantially reduce the cost involved in CDR management. Sometimes the mining and analysis, except for criminal investigation, can create problems for the telecom operator like one related to privacy. With more countries moving towards stricter privacy and security laws it can become pretty complex for the operator to abide by all the laws and perform the analysis. In TTP based CDR Management System the technological and compliance risks are transferred to the trusted entity and telecom operator can count on this reduction in risks and expenditures related to CDR management for better user experience and profits.

## II. RELATED WORK

Qining Lin and Yan Wan in [1] present an approach for customer clustering for marketing campaigns. Kamola, M et al in [2] try to reconstruct the social graph of individuals. Olusola Adeniyi Abidogun in [3] presents an approach for neural network based analysis of call patterns. Chih-Ping Wei et al in [4] try to predict customer churn with the help of call patterns. In all of the above approaches the analysis is solely base on the call detail records. If it can be made possible to get access to wider range of CDRs then the analysis approaches can be optimized and better results can be obtained. Here in this paper we present such an approach for providing better management and analysis of Call Detail Records.

### III. APPROACH TO TTP BASED CDR MANAGEMENT

Generally, the CDRs are stored and processed by the telecom service provider and often the CDRs are analysed to obtain market trends. This analysis can be performed by the telecom service provider or it can outsource the work to some other company. The interests of both the companies are secured by a contract. In the proposed architecture a Trusted Third Party (TTP) is involved. This TTP performs the storage and processing of CDRs on behalf of multiple operators. In addition, TTP takes care of individual and combined analyses of CDRs as well. TTP, under contract, also fulfils the security and compliance criterion set up by industry and government, such as storing CDRs for a particular period of time before deleting the records, certain complex issues like maintaining customer privacy can also be simplified to some extent.

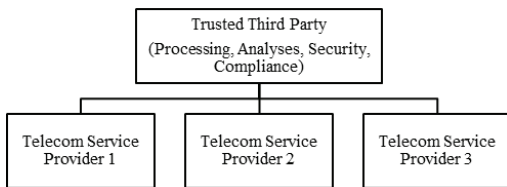The architecture of the proposed system is rather simple to design, as shown in Figure 1.



Figure 1: Architecture of TTP based CDR Management

In the above architecture there are two parties, the telecom service provider (TSP) and the trusted third party. The CDRs are generated at telecom service providers' end, which are the then transferred over the internet to the TTP. This transfer of CDR data can be done on daily basis. A time must be fixed for the transfer to begin for each TSP separately. Transferring CDR data from all TSPs at the same time can be challenging and at some point in time may overwhelm the network bandwidth of the TTP. To prevent such incidents the transfer timings must differ by some, experimentally identified, minimum duration. After successful transfer the telecom service provider need not maintain the real data or the backups for long time. The TSP need only maintain backups of few days only, suggestively, to meet some unforeseen error in transfer of data.

After the data has been transferred it is checked for its correctness at the TTP side. If some errors are found retransmission can be requested, else if data is error free it is stored in the datacentre. Now it becomes the responsibility of TTP to fulfil all technological and legal requirements regarding the CDRs on behalf of telecom service provider. The TTP maintains enough security to ensure that confidentiality, integrity and availability (CIA) of the data is intact. It is the TTP that ensures the compliance with the industry standards and government legislation. The TTP performs all the processing and analyses on CDRs and provide accurate results back to the telecom service providers. The TTP performs all these operations and ensures that it keeps itself in profits to provide value to the business. Proper optimization techniques

and business intelligence must be applied to keep it from running into losses.

### IV. ASPECTS OF THE APPROACH

#### A. Financial aspects

The technological changes from voice call to SMS, 3G and now 4G – besides providing improved user experience have only added to the growing volumes of the CDR, resulting in the dramatic rise in the IT infrastructure costs to handle the growth. Due to the huge volume, data retention and disposal policies become difficult to enforce, resulting in the extended storage of the CDRs than necessary. This situation besides introducing compliance and security problems, results in unnecessary additional storage costs. Coupled with increasing saturation and competition in the telecom market, the TSPs are forced to look for new measures to reduce costs. This TTP approach can go a long way in helping TSPs to cost-effectively manage this huge volume of CDRs. The TTP can bring down the cost for TSPs by large scale processing and storage deployment in a central location. TTP can help the TSPs in the following:

Reduce storage cost: The TTP storage solution will reduce the need to maintain full storage deployment at the TSPs end. Only few days archive will be needed to be maintained by the TSPs. Also by deploying large scale datacentre the TTP can also bring down cost and a central management system will provide efficient IT finance management. Therefore TSPs will benefit from reduced IT hardware/software expenditure and TTP will benefit from a central management for multiple TSPs.

Reduce maintenance cost: The CDR management activities like backup and recovery will be transferred to the TTP. TSPs will not have to maintain specialized software for maintenance. The TTP will handle all the software and hardware maintenance activities. Also there will be reduction in the number of staff associated with the CDR management activities, which will further reduce TSPs expenditure on training and maintenance of staff. As for the TTP, this approach will reduce the total number of staff required to maintain the system for multiple TSPs.

Reduce administration cost: With transferred CDR management to TTP there is reduction in the number of IT systems and staff which helps in bringing down the administration costs for TSPs. Also internal audits related to CDR management system are also reduced bringing down the costs associated with audit software and storage. Reconciliation of charges among the operators will be eased out since it can be managed by the TTP on behalf of the TSPs, thus further reducing the burden.

Based on whether a TSP decides to transfer its billing activities to TTP, the TSP can also save on billing management system. Post-paid billing service can be easily handled by TTP as they are not required to be calculated in real time. Also other features like fraud management system can be applied by TTP to protect the TSP from frauds. TTP can apply latest cost effective cloud computing and business intelligence techniques more easily which will provide

optimization for both the TTP and the TSP. This solution will enable the TSP to reduce expenditure on data and content management system and other tools that may be required and will help in faster revenue realization and may pay for itself in a very short span of time.

### B. Technological Aspects

The main issue with the third party storage is the management of chargeable information and generation of accurate charging. The TSP can decide whether to outsource charging to TTP or do it in-house and only move the archived CDR to storage. In case the TSP decides to process billing in-house, then it will have to store the CDRs for a particular period of time under its own control and after processing, the CDRs are sent for long term storage on TTP servers. And if the TSP decides to outsource the billing process as well then TTP will have to deploy systems for efficient and accurate billing to the TSP. The security of CDRs during transit is also an issue. For accurate data management, it is necessary that the data must be transferred in a very secure manner. Protocols must be agreed upon for the transfers, their timing of transfers, etc. security of CDRs during transit must be ensured by both TTP and TSP.

The CDR data is stored in various formats depending on the types of service. The cost of handling the rapidly growing data is becoming a challenge to TSPs. The cost of analyses, security and compliance is continuously on the rise. The proposed architecture can reduce can reduce the financial burden besides providing technological edge. The operator does not have to take care of the storage systems and the related security. Transferring it to TTP will help reduce risk and protection from any such failures as agreed upon in contractual agreement. The TTP which maintains the central repository can take care of security more effectively and TSP can better concentrate on the services to customers. Effective implementation of technologies will help reduce compliance risks for both the TSP as well as TTP. TSP can offload all compliance requirements regarding CDR to TTP under contract and in case of any violations the TSP can recover the losses from TTP. Data mining will become lot more easy and effective with the central architecture. Currently, TSPs deploy their own mining and analytics systems and getting rid of them will help save cost on hardware, software as well as manpower. The TTP can mine and analyse the CDR data on behalf of TSP and furnish the findings. In [5], [6], [7] possibilities and approaches are presented which shows the variety of analysis that can be performed on the call records. Also, the TTP will be able to perform a generalized analytics based on the data from multiple operators. This generalized analytics will give a deeper insight to the national trends to as to where the telecom market is headed. The TSP can then compare its own analysis with the generalized analysis to determine whether they are on right path or to set new strategies to better align to the newer trends.

Technological benefits of keeping CDRs in centralized manner:

- TSPs will require fewer infrastructures for storage and processing.
- Data mining will become easier and efficient.
- Grievances handling, related to billing, will improve due to reduced involvement of TSPs.
- The cost of training employees will reduce bringing down the overall maintenance cost.
- TSPs will be able to fulfil compliance requirements more effectively.
- TTP based centralized CDR will help in reducing fraud in telecommunication.
- Security implementations will become effective and efficient.

### C. Legal Aspects

By moving the CDR storage and management to TTP, telecom companies can expect enhanced regulatory and compliance efficiency. In the proposed methodology the risk will be transferred, in partial, to the TTP which can concentrate in a better way to tackle the risk. The proposed system will benefit the telecom companies in ways by reducing their interaction with legal and compliance authorities on grounds of demands and expectations. Here we can take a scenario, like if a request is received for obtaining the call records of any individual, the telecom company can direct the request to the TTP and ask the requesting authority to directly deal with the TTP. The TTP under contractual limitations with the telecom company fulfils the request of the authority with minimum involvement of the telecom company. The repeated requests can then be directly handled by the TTP. This way telecom companies can reduce their efforts spent on fulfilling legal requests while having full knowledge of the transactions taking place between the legal authority and the TTP.

Also it will become easier for the legal authorities to obtain CDR for different companies from a single point of contact. This will make the process faster and efficient on part of legal authorities by providing wider access in lesser time. Data collection and analysis time will reduce providing more time for other activities to hasten up. As for the compliance is concerned, drastic improvements can be expected with this centralized approach. First of all, risk exposure for the telecom company is reduced. Secondly, the TTP will employ full scale efforts to ensure compliance, since this is what is expected of the TTP and is one of the main assurances provided by TTP to the telecom partner. This will reduce telecom companies' defaults on compliance grounds and will help improve rapport with the customers as well government authorities. Further, improved analytics can be applied to detect crime patterns and newer technologies, such as Big Data, can be used to handle the compliance issues.

## V. Conclusion

The proposed methodology provides a way for telecom companies to reduce their risk exposure at the same time having full control over their data. The effort and expenditure for handling the archived CDRs is reduced, ensuring profitability in the long run. With this centralized methodology, newer and improved analytics can be expected to develop which can give us more insight of the user trends

and better data handling technologies can be developed which are more cost effective and efficient for all at large.

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