

Network Management/OSS: eTOM

A Case Study to Evaluate Factors that Influence the Performance of the Billing Process

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Abstract—This paper discusses factors affecting the billing process of fixed line Telecoms operators, resulting in leakages of revenue. The lack of inter-operability and external factors are discussed in detail. In a case study factors which were found to affect performance of a SADC telecom operator are detailed. The study entailed analyzing billing process of a service provider in a SADC developing country, and internal factors which were found to be limiting to performance was lack of inter-operability between billing related functional units. T

I. INTRODUCTION

Shareholder's expectation of a company is to maximize profits and to ensure sustainable growth, with large emphasis placed on the collection revenue. Cash flow considerations and time value of money [16], dictates that revenue should be collected sooner rather than later. Additionally, for profit maximization purposes telecom operators should constantly embark on minimizing costs and eliminating revenue leakages with stringent revenue assurance strategies[1].

The billing process enables the creation of invoices by collecting usage data from the network elements, processing and formatting this data into service detail records and finally periodically compiling the rated usage data to render an invoice to the customers. Quality billing requires accurately billing all customers, rendering the bill as soon as possible in a cost-effective manner. Revenue collection and customer care are also often associated with the Billing responsibility.

The purpose of research is to identify factors that influence the performance of the billing process in the Southern African Development Community (SADC) region. The context was limited to SADC, firstly because little research has been done on revenue assurance in the SADC region. Secondly, Africa's telecom industry is still extremely untapped with a low teledensity [8]. Research by the Economic Commission for Africa indicated that in 2003 only 6% of the world's internet users are based in Africa and finally, the deregulation of the telecom industry in Africa is still in its infancy [13], [8]. Therefore, understanding these factors will not only benefit

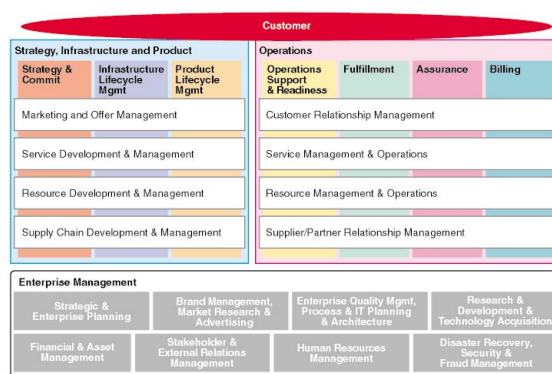


Fig. 1. eTOM Process Model

revenue assurance for Africa, but it will also benefit future network operators. Hence we performed a case study on a SADC telecom operator, to analyse conditions under which this service provider operates and the factors which mainly enforce or hinder successful billing, internally and externally. Further research will focus on similar operators in the region.

II. BACKGROUND

This section gives an overview of background work in billing and the structure of processes and how it fits within the bigger picture of Operations Support System (OSS). The billing process and its subcomponents are discussed in detail. We also discuss revenue leakages and factors affecting performance and costs of billing.

A. The TMF eTOM Model and Operations Support Systems

The Enhanced Telecom Operations Map (eTOM) is a business process model developed by the TeleManagement Forum (TMF) as a business framework to describe enterprise processes needed for efficient and effective management of the telecommunication business with reference to figure 1.

It consists of three high level process groupings: 1) Operations, 2) Strategy, Infrastructure & Product and 3) Enterprise Management, that overlays the first two process groupings. The Operations process grouping consist of four vertical processes; Operations Support and Readiness, Fulfillment, Assurance and Billing [9]. Running horizontally across the four process groupings are cross-sectional layers that define the sub-processes at a functional level within each of the vertical processes. Below we discuss the sectional layers in relation to the billing process, see figure 1 provided by Ronco [9].

- **Customer Relationship Management (CRM)** ensures increased customer satisfaction with respect to bills produced and account management, i.e. customer care services, credit control, collection of outstanding fees, dispute resolution and distributing invoices.
- **Service Management and Operations (SM&O)** involves the rating of usage records compiled, compiling the invoices, applying service discounts and rates, updating and managing rate plans and tables.
- **Resource Management and Operations (RM&O)** sub-processes ensure that service usage data is collected fully, error free and formatted into a call detail record and forwarded to the billing systems
- **Supplier/Partner Relationship (S/PR)** manages relationships with the suppliers of the billing, mediation, rating systems, interconnect contracts and other partnering relationships that affect or are affected by billing.

The billing process flows from RM&O, which involves data collection and mediation, to SM&O which involves rating and discounting and finally CRM which involves printing, distributing and collecting revenue, across the cross-sectional levels in figure 1. Other functional units that interact with the billing process are Customer Care Services, Sale & Marketing and IT & Infrastructure.

B. Billing Process

The Billing Process is responsible for collecting usage data regarding usage of services by customers from the network component; processing this data to produce an accurate invoice in a timely manner; collecting payments; updating accounts; and ensuring efficient collection of outstanding revenue. Process flow and information flow in billing is indicated in figure 2, by Hunter and Thiebaud [4]. The major components are:

- **Data Collection and Mediation** collects usage data from the network components and produces a billable format, call detail records(CDR), containing the information needed for billing, i.e. usage duration, service type, start and end time, dialed and dialing number.
- **Rating** assigns a monetary value based on the information contained in the CDR, by searching through rating, customer and service databases and applying the appropriate monetary value to the CDR.
- **Compiling** applies once off payments, runs the bills for the months and compiles invoices based on the CDRs

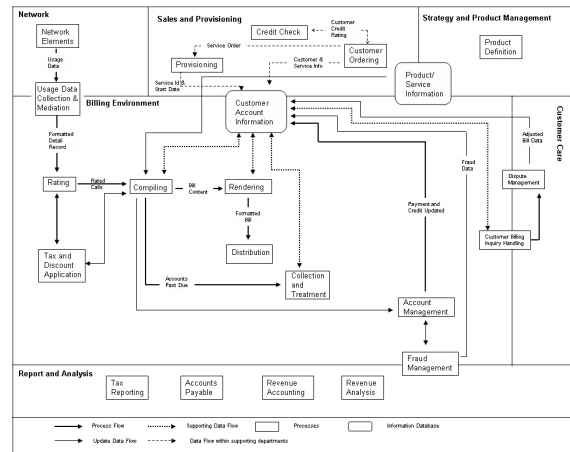


Fig. 2. End-to-end Process Flow of Billing

and rating done through the month. The invoices are then printed and forwarded for distribution to the customers

- **Collection and Credit Management** collects outstanding payments from the customer, ensuring that full revenue is collected sooner, such that the debtor's age is minimal.

Quality of the billing process depends on time (efficiency) and accuracy.

Accurate billing is crucial for both customer satisfaction and for realization of revenue in full. Data integrity across the billing process is imperative for accuracy of invoices produced. This requires that output data at each processing phase should correspond to one another.

Customers' account and service related information should also follow suit, from sales and marketing to billing. Any discrepancies in the transition of data across different phases will result in either very unhappy customers or lost revenue. Due to the concept of time value of money, a Rand in the hands of the service provider today is worth more than a Rand in the hands of the service provider a year later.

Worldwide [5], [2], service providers are losing 10-15% of their revenue to leakages that exist because of; poor process designs, human intervention, corrupt or lost usage data, incorrect rate application and poor order processing. The following section discusses revenue leakage points and sources of leakages in detail.

C. Revenue Assurance

The TMF Revenue Assurance team define revenue assurance as [14]:

Data Quality, process improvement methods that improve profits, revenue and cash flow without influencing demand.

The purpose of revenue assurance is to identify, monitor and eliminate revenue leakages, and to ensure that revenue is collected fully from the customers and that none is lost to increased costs and fraud [3], [10], [7], [14].

Revenue leakage is a loss of revenue in any form, caused by a factor or an event whereby its existence or occurrence, respectively, results in either increased costs being incurred or delay in the realization of revenue.

According to literature, [3], [10], [7], [14], [2], these leakages occur mainly at the following interfaces:

- *Network Management and Data Collection & Mediation.* Usage data can be mishandled, corrupted or lost during system handover between switches and mediation systems, resulting in unbilled calls and unrealized revenue. Poor network configuration, such as incorrect clock setting can also result in inaccurate data being generated and, in the worst case, data not being recorded at all.
- *Rating and Compiling.* Lack of data integrity, that is service information can service as a sources of revenue leakages between this interface. Losses occur because the billing system will attempt to rate services that are not in the services database and this usage data will also fall into suspense.
- *Order Management and Order Processing.* Contracts are cancelled but services are not de-activated at times, service is provisioned but a billing account is not created, or vice versa, increasing customer care costs and the amount of data in suspense, and as a result delay revenue realization.
- *Collection and Credit Management.* Poor credit checking facilities, and failure to track customers can hinder the efficiency of collecting outstanding revenue.

The abovementioned are some of the leakages of revenue that can be experienced by the service provider if processes are not managed tightly.

III. RESEARCH METHODOLOGY

The approach followed in collecting information regarding the billing process is a detailed study on the actual process used in billing customers, the billing system used and the problems encountered by the service provider. The design of the case study followed the methodology described by Yin [17], incorporated with Six Sigma methodology for data collection and analysis [18]. Data collection, and analysis was achieved through conducting interviews with different stakeholders of the billing process, observing the process, and analyzing archival data and process documentation.

The research was directed at answering the following question:

- What are the factors affecting the cost of billing?

Through this we aim to answer questions regarding costs incurred, major cost consuming components and percentage of costs incurred due to inaccuracies of bills and inefficiencies in the billing process.

For operators to see success in their billing process, these factors need to be well understood, measured and monitored effectively and regularly. If it cannot be measured then it cannot be managed and it has to be by the right metric.

A. Data Collection

The data collection was mainly achieved through conducting interviews with the employees working in billing and other billing related departments, i.e. customer care, network management, credit control and IT. The data collection was broken down into two partitions: process mapping and defect identification. Process mapping was directed towards developing a process model of the major activities carried out in billing, the flow of activities and to identify the resources used. The second partition, defect identification, was done once the process of billing within the service provider was well understood and verified with all participants. The data collection was mainly achieved through conducting interviews with the employees who worked in billing and other billing related departments, i.e. customer care, network management, credit control and IT. The data collection was broken down into two partitions: process mapping and defect identification. Process mapping was directed towards developing a process model of the major activities carried out in billing, the flow of activities and to identify the resources used. The second partition, defect identification was done once the process of billing within the service provider was well understood and verified with all participants.

B. Validity of Data

The validity of data collected was verified by using different data collection sources; interviews, non-participative observation and analysis of archives and some reports produced by departments periodically.

For interviews conducted on multiple participants we used the same questions, to highlight any discrepancies or differences in the information provided. Non-participative observations were performed in a non-imposing manner, to reduce the risk of participants altering the processes used when carrying out activities.

Participants were also provided with workflow surveys, and before and after interviews in order to compare the deviation of information given before, during and after the interviews were conducted [6], [17]. Archival data was also collected to validate the information collected.

IV. RESULTS

This section discusses internal and external factors identified at a service provider studied; SP1. We discuss the major causes of revenue leakages and we indicate how these factors result in performance deviations.

A. Background of SP1

SP1 is a telecom service provider in a developing country in SADC region, with a population size of less than 2 million citizens growing at a rate of 0.1%. This developing country has a GDP of less than \$10 billion and a labour force of approximately 45% of the population. As commonly found in this region, a large percentage of the households depend on remittance income from mainly men who are migrant labourers in other countries. SP1 is a small service provider with

TABLE I
COMPARISON OF PERFORMANCE INDICATORS

Indicator	International Standards (IS)	SP1
Target time for making data available to billing	2 hours	24 hours
Frequency of bill run	On request (immediate)	On request (24 hours) ¹
Average time between bill cut-off and distribution	1.5 days	7-10 days
Number of adjusted bills per 1000	0.1	Unknown
Unallocated cash reconciliation	1 day	2-3 days
Customer queries relating to billing	0.44%	8%

less than 80 000 customers and less than 5000 active lines. The average revenue per user (ARPU) is considerably less than \$100. Approximately 46% of the revenue is generated by government and corporate customers, 47% from the telecom bureau (public phones, interconnect, etc.) and only 7% from residential customers. It is important that we state that SP1 is a fully functional operator, which is currently making a profit, regardless of the performance of their billing system.

From information on the size and capacity of SP1 and the country, we can see that it is one of the developing countries where the revenue generated does not justify buying an expensive billing system that will minimize leakages. The digital divide and technological gap make revenue assurance strategies defined for first world countries almost impossible to plug and play.

B. Comparison of Performance indicators

Performance indicators of the billing process give more information on the quality of the billing process. The following indicators, depicted in Table I, are from the results of the billing benchmark developed by the Global Billing Association for 2003 [11], [12], [10]. This research identifies the internal and external factors that influences the values given in Table I.

C. External Factors

Regardless of the facts stated in Section A, operators in this region need to consider external factors that they are subjected to and design revenue strategies around these uncontrollable factors. External factors observed during data collection in SP1, not necessarily limited to SP1's country, are land allocation policies, a poor identification system, lack of inter-agency cooperation and infrastructural development.

1. Land allocation policies within the country

The customary land allocation system, where land is mainly allocated to people by the village chief at their own discretion can introduce problems to the country. This results in undocumented land allocations, a high level of unplanned settlements and loose-knit urban settlement patterns, resulting

in undefined addresses. A similar problem was experienced by SP1 where 40% of their customers lived in areas where some of the households had undefined addresses.

Effects on billing:

The effect is delayed payments, since bills can only be distributed to post offices or collected by customers from the service provider. Data capturing is error prone and there are several incidences in SP1 where installations were done at incorrect houses. Credit management finds it difficult to vet customers and to track non-payers.

2. Poor Identification System

Some citizens outside of the urban areas do not yet have Identity documents. It poses problems for any organization that provides services on credit. A well structured identification system, that is enforced upon citizens, facilitates sufficient credit checking and also assists in the collection process.

Effects on billing:

This increases the risk of incurring increased bad debt. Intensive credit checking is impossible for customers with no ID documents. The failure to do intensive credit checking is precipitated by lack of addressing system in remote areas, making service provider a prey for fraudsters who apply for services with no intentions to pay for usage, therefore increasing fraud.

3. Lack of inter-agency cooperation

Inter-agency cooperation can facilitate the pooling of risk information on customers, assist in tracking delinquent customers who do not pay bills during relocation and protects the service provider from customers unworthy of credit. The unavailability of an external credit checking agency can result in an increased level of bad debt.

Effects on Billing:

Customers that are not worthy of credit services, based on profiles with other credit providing agencies, may end up being vetted as a credit worthy customer. It is a major leakage of revenue caused by increased bad debt and increased collection and credit management costs. The service provider only has a limited view on the credit worthiness profile of the customer and subjects themselves to a bad debt. All the above factors put together in a single country can be hazardous for the service provider's cash flow and debtor's age.

4. Infrastructural Development

In any country, infrastructural development and commercial development is depended on the topography. If the topography makes it cost efficient for infrastructural development to extend further than the urban area, which tends to be small in undeveloped countries in comparison to the size of the entire country, then the possibility of placing the right infrastructure to provide services to facilitate other supporting processes is limited.

Effects on Billing:

The topography limits the rate of developing infrastructure in the country. For the operator to be able to collect the

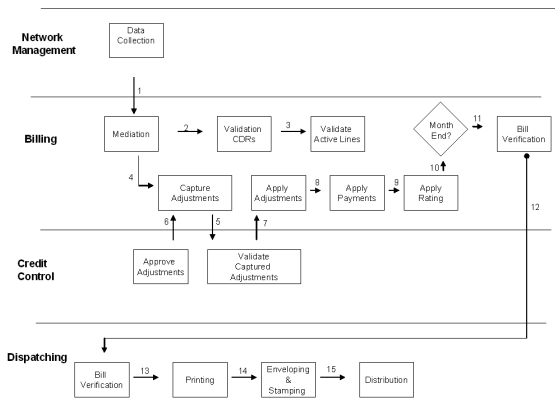


Fig. 3. End-to-end Process Flow of Billing in SP1

revenue generated efficiently, payment points should be easily accessible to customers. However, the cost of placing infrastructure in remote areas with minimal customers outweighs the revenue generated by these customers. To meet both the needs of ensuring accessibility of pay points without making an investment with a minute rate of return, the SP has offline pay points, as a result skimming becomes a problem. Service activation is also delayed.

D. Internal Factors

Internal factors and loopholes within the service provider can result in losses if they are not identified, monitored and managed effectively.

All components required for billing in SP1 are fully functional and meet the objectives. The problems experienced are due to limited automation, a high degree of human intervention, lack of inter-operability and poor performance monitoring and inefficiencies which cause increased costs and delayed realization of revenue. One of the greatest sources of leakages identified is inter-operability between interacting processes. The billing process interfaces with multiple departments/processes. Inter-operability of systems ensures a smooth interaction between these processes. We discuss lack of inter-operability effects on the billing process, based on the billing process of SP1.

Lack of Inter-operability

1. Network Management and Billing

The usage data is the most important type of data an operator can generate. Billing and the switches need to be interfaced tightly to prevent fraud, data loss and data corruption. Interface 1 in Fig. 3 was found to have risks of data loss, data corruption and redundancy which introduce delays in the billing process.

Transferring data from the exchange server to the billing system is manual, using optical disks as is often the case in the SADC region. The unnecessary introduction of human intervention creates opportunities for errors, data loss and

corruption and of bill production. The billing system's capability of checking for duplicate or missing CDRs is limited. Data integrity is highly important to ensure that service provider does not lose revenue or does not overcharge customers, increasing customer care costs.

2. Credit Control and Billing

SP1's Billing process interacts with credit control at interface 5, and 7 in Fig. 3. This interface is in charge of applying adjustments, rebates and interest charges to the customer's account. The interaction between these two systems is manual and paper-based. There is redundancy in capturing adjustments, i.e. adjustments can only be captured in the billing department. If the system used by the billing and credit control processes was inter-operable then the credit control department could automatically update adjustment and eliminate the need for manual valuation of adjustments, eliminating redundant activities and reducing error probabilities.

3. Provisioning and Billing

For new service activation an account has to be created on the billing system before the service is installed, to ensure the production of a bill as soon as the service is active. The service provider's billing process has to create the account, set it as pending to ensure that it does not start billing the customer (e.g. for rental fee) before the service is active. Often a service activated in the exchange is not the same service activated in the billing system. For example, often the customer's service was configured as postpaid on the network, but set as pre-paid of the billing system. As a result, a bill is produced for a customer with rental charges, wasting resources and increasing customer queries and costs. The two processes do not ensure integrity of service information on the exchange system and that of the billing system

4. Customer Care and Billing

Customer care depends on Billing for information needed to resolve customer queries. Lack of inter-operability results in increased dispute resolution time, because Customer Care has to sometimes wait for billing to provide it with information. Since providing customer care with information is not on the highest priority list for Billing, at times this adds time to the dispute resolution and increases customer dissatisfaction.

E. Open Item History

The net effect of the external and internal factors is on the collection efficiency. The open item history gives an indication of the age of outstanding debt. The open item history is calculated from the outstanding balance, including current bills which have not yet passed the due date (current), and the total outstanding for 30 days, 60 days, 90 days and 120 days, calculated using equation 1.

$$\text{Open Item History} = \frac{\text{Average open items for period } i}{\text{Average invoiced per month}} \quad (1)$$

TABLE II
OPEN ITEM HISTORY

Age outstanding	% of total outstanding	% Open Item History
Current (not yet overdue)	43.93%	88.76%
30 days	12.42%	25.09 %
60 days	2.52%	5.14 %
90 days	1.62%	3.28 %
120 days	39.5%	82.39 %

It is interesting to see that almost 40% of the total outstanding balance has been outstanding for at least 120 days. This indicates the effects of the external factors on the collection efficiency process. The revenue collection process is limited by the above mentioned internal and external factors.

V. CONCLUSION

We collected data from SP1 to understand factors affecting performance. This data indicated that the billing process is affected by both internal factors and external factors, especially in the SADC region. These factors may limit the performance.

External factors identified were lack of addresses for some residents, a poor identifications system which does not enforce all citizens to possess an ID document, and lack of inter-agency co-operation. These are external factors that predicated problems with timely distribution of bills, collection of debts from bad payers, fraudsters who apply for services with the intention of not paying.

Internally, lack of inter-operability between interacting functional units formed the biggest source of problems identified within the process. Poor inter-operability results in increase error rate, redundancy of activities, delays in bill processing and dispatching and finally delay in revenue realization.

Lack of inter-operability was found to be the major internal source of leakages and hindrances to revenue assurance. In SADC telecom service providers, perhaps the generated revenue does not qualify for a high-tech billing system, The important question before concluding should be:

How much are these operators losing from the following:

- *the lack of inter-operability between different billing related systems ;*
- *increased human intervention; and*
- *Process and technical inefficiencies that increase costs or lost revenue?*

The preliminary results entailed highlighting these factors. We identified the major factors that led to the conclusion of inter-operability as a major factor. Further work in progress, will highlight the effects of these factors on costs or revenue collection, supported by quantitative data being collected presently and more case studies to evaluate transferability to the SADC region.

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BIOGRAPHY

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