DATA QUALITY ASPECTS OF REVENUE ASSURANCE

(Practice Oriented)

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Abstract: Revenue Assurance describes a methodology to increase a company's income by determining where revenue gets lost, and to maximize their profits by eliminating revenue leakage and lowering operating costs. Especially in times of increasing data volume and more and more complex business and operational systems infrastructure, it is a challenge to find methods for detecting revenue leakage and its reasons. In this paper we will focus on the data quality aspect of revenue assurance and introduce a method to detect revenue-related data quality problems and their root causes. For high parallelism and efficiency a grid-based database is used to load all relevant data according to a defined metamodel, calculate adequate quality criteria and generate cleansing reports. This method is supported with a case study in the area of telecommunication returning a significant result of underbilling. Sample of the used quality criteria and scenarios of the cleansing procedure are given in detail.

Key Words: Data Quality, Revenue Assurance, SOX compliance, KPI

INTRODUCTION

The magnitude of data quality problems is mostly unrecognized and is often treated like an unwelcomed necessity. The results of a data quality project are unpredictable and its worth for the company is hard to measure, which encourages executives to be very sceptical about embarking on such a project. On the other hand correct data is a key issue for correct financial reporting, especially for companies listed at a US stock exchange (SOX compliance). Analyzing data quality problems in respect to revenue assurance gives an instrument for a concrete measure of the revenue loss in money terms and hence of the project's worth.

Revenue Assurance (RA)

Revenue Assurance is the use of data quality and process improvement methods to improve profits, revenues and cash flow without influencing demand. A set of techniques and methodologies is used to identify and repair revenue leakages as well as to detect and prevent errors resulting in unbilled or uncollected revenues. Revenue Assurance was defined and standardized in [3] by a TeleManagement Forum working group. It is mostly used in the telecommunication area. Reasons for revenue leakage are data quality issues like interconnect inconsistencies, loss of data or corrupted files, as well as problems with business processes like manual or ill-defined processes. Performing a revenue assurance project is important, not only to detect un-billed or mis-billed customers, but also to understand and in the end to eliminate the reasons for such undesired occurrences. In [2], different approaches to RA – Reactive, Active and Proactive Revenue Assurance were defined.

Reactive Revenue Assurance

Reactive Revenue Assurance is used to just detect the existing revenue leakage. Here are projects set to identify and resolve the causes of actual revenue loss.

Active Revenue Assurance
Active Revenue Assurance addresses problems as they occur. This approach is designed to initiate corrective responses prior to incurring any losses. The actual business process is monitored in real-time. Discovering problems in real-time helps in correcting the leakage before it causes damage and impacts the customer.

Proactive Revenue Assurance
Proactive Revenue Assurance acts in anticipation. Controls and other measures are implemented in order to prevent problems from occurring in advance.

The methods described above are complementary. As a first step, it is important to detect and fix the actual revenue leakage in a company. After finding the reasons for that, active or proactive RA should be implemented to prevent damage or as an ultimate goal to prevent the occurring of leakage.

Data Quality Issues and Process Improvement
RA can be approached by data quality or process improvement ([2]).
The data quality approach uses data quality methods to detect and clean the revenue leakage. This paper emphasis the data quality aspect of revenue assurance, thus this approach will be described below.
The process improvement approach uses business methods to identify, where potential areas of leakage might exist. For that, reviews of the business processes that are relevant for the management of revenue related issues are taken.
Especially for detecting the reasons of RA, it is important to use both, data quality methods and process improvement. Analyzing business processes gives important information for defining adequate quality criteria in data quality measurement.

Revenue Assurance and SOX
Companies listed at the stock exchange are obligated to international and statuary regulations covering billing accuracy, network and service availability, customer relationship management, privacy of customer data, revenue booking and recognition or settlement between companies. The Sarbanes Oxley Act of 2002 (SOX, [4]) is considered the most significant regulation with respect to its immense regulation catalog. RA relevant sections of these regulations are the demand of Accuracy of Financial Statements (Section 302) and the demand of Internal Controls (Section 404). These sections describe following obligations:

- Designing, Establishing and Maintaining the Disclosure Controls
- Evaluating the effectiveness of Disclosure Controls
- Presenting Conclusions
- Fraud, Deficiencies and Significant changes in the Disclosure Controls should be disclosed
- Management accepts responsibility for establishing and maintaining Internal Controls
- Management is responsible for assessing the effectiveness of Internal Controls
- External Auditor attests management's assessment of Internal Control

While SOX compliance requirements are key-drivers for data quality and risk management initiatives, RA ensures data integrity for financial reporting, detects leakages at system integration points and provides evidence for internal control evaluation and documentation.

Data Quality and Revenue Assurance
There are many definitions of data quality. Juran ([1]) defined data quality as fitness for use. Dimensions of data quality like accuracy, correctness, completeness and relevance were named by [5]. In practice, especially in times of growing data volumes and more and more complex business processes using data quality methods becomes a more and more important and challenging issue. Revenue assurance and SOX

compliance raises the priority and necessity of the use of data quality methods. To aim the goal of high data quality in respect to revenue assurance, a set of quality criteria has to be defined, considering the accuracy, correctness, completeness, relevance and consistency of the data. For finding revenue leakage, the process flow of the data, beginning with entering in the front-end system up to invoicing in the billing system, has to be considered. The question of existence of a realized or sold product, which is not at all or not correctly billed to the customer, has to be answered. This is done by extraction of the data of all involved systems and by evaluating the quality criteria of the data in all different systems, considering both, quantification issues and analysis for finding the causes of the problem.
RA distinguishes two kinds of mis-billing: underbilling and overbilling.

Underbilling
In this case, the customer orders a special product, the product gets provisioned and the customer can use the product, but the bill does not invoice that product. In some cases the customer pays a different cheaper product and in some cases the customer pays no product of that type at all. For the company, revenue loss happens in any of these cases.

Overbilling
The other way occurs less often than underbilling. Overbilling defines the case where the customer gets billed too much. The ordered and provisioned product does not appear on the bill, but perhaps another not provisioned product appears on the bill. The customer complains about overbilling more often than underbilling. For a company listed at the stock exchange, this has serious effects, since the Sarbanes-Oxley-Act of 2002 demands cleaning of overbilling.

Cleansing
The recognition of data quality problems is not enough. After the evaluation, the effected data has to be prepared for cleansing. For that, the relevant systems as well as process engineering departments have to be involved. For efficient cleansing we have to distinguish two kinds of data quality problems. *History problems* are inconsistencies originating at migrations, introduction of new systems or processes and already cleansed process problems. These problems have to be recognized and cleansed in the data; they are solved after cleansing and will not occur again. *Problems of process* are more difficult. These problems originate from process problems and occur again and again. Finding and eliminating the process problem is the key issue here. After fixing the process, the problem can be treated like history problems and the data can be cleaned.
It is not sufficient to look at every single ratio of the quality criteria and try to clean these separately. An effective cleaning process includes the fact, that one customer's or bill's problem is caused eventually by several criteria.

CASE STUDY: REVENUE ASSURANCE IN A TELECOMMUNICATION COMPANY

A data quality project at a European telecommunication company (ET) was first initiated in order to support the migration of customer and contract data from two systems into a new CRM-system. But by and by the requirements and thus the quality criteria grew dynamically and resulted in a central data quality project, moving the focus lately on revenue assurance.

Operational Systems Architecture

Aiming the ultimate goal of proactive revenue assurance, it is necessary to look at all revenue- and profit

related areas of the systems architecture. Below you see the process flow of the company. From entering the customer and contract information in the CRM- system (CrmS), the provisioning- relevant data flows to the provisioning system (ProvS), the customer data gets sent to the customer system (CustS) and the contract data moves to the asset system (AstS). The billing system (BillS) receives all necessary information from the customer, asset and provisioning system. In addition the billing system orders call records for every asset from the rating system (RatS). The here described systems communicate over the process using different, mostly technical keys.

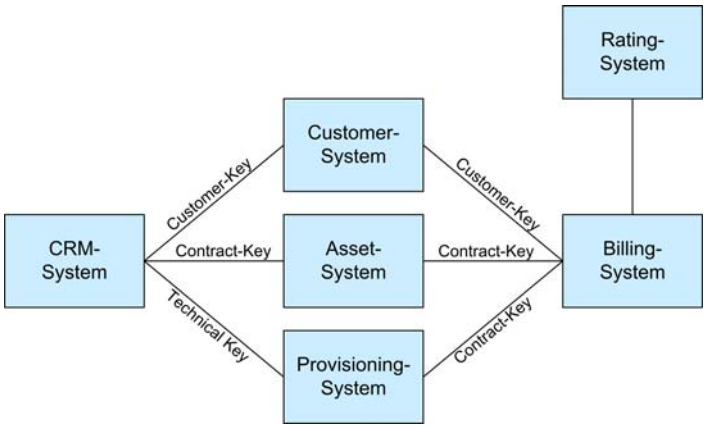

Figure 1: Operational Systems Architecture

Revenue Assurance

The data quality project at ET aims for proactive data quality and revenue assurance. Reactive methods using the Miocon Context Server with integrated grid-based database are implemented as a first step. These and the concept for proactive data quality are described below.

Reactive Procedure

Convincing the management for the urgency of a revenue assurance project, a first quantification of the actual revenue problems is very useful.

For that, customer and contract data of all revenue-relevant systems are extracted and loaded into the database. Comparing all relevant data in the analysis database is preferred versus sampling the data. Since the problems are not linear distributed, the effort of creating a good and representative sample is higher than the handling of all data in a efficient database. For efficient loading of the collection of data into the database according to a metamodel, a grid-based system is used. Therefore high parallelism and because of the use of Windows operating system low hardware costs are reached. For the revenue assurance project 1.5 Tera Byte of revenue-relevant data were loaded in a timeframe of one day. Loading all the data in an extra analysis database is necessary, since there are no capacities for analysis searches directly on the productive systems. Moreover, the timeframes and efficiency of unloading a system are that low, that a structured unload is not possible. Instead of that we included a preprocessing phase structuring the unstructured unloads.

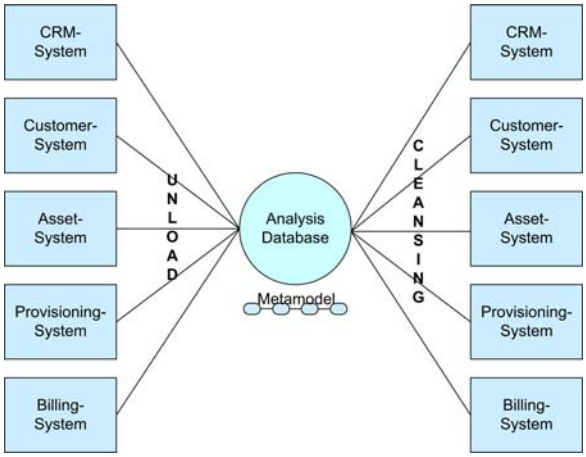

Figure 2: Reactive Procedure

The data is loaded into database according to a previously defined metamodel. The metamodel reflects both, the purpose of the analysis and the structure of the data. Defining the metamodel is one of the key points here. If the goal of the project is just to know the dimension of the problem, the metamodel looks like in Figure 3. The model reflects the structure of the data: One customer can receive many bills, in which many contracts or lines are included. One contract consists of one-to-many products, on which there is set a price. At least the data of the provisioning system and the billing system has to be loaded into this model. After the load adequate quantification KPIs are computed and evaluated (see section below).

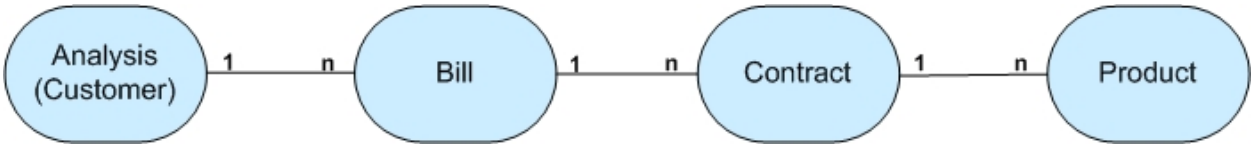

Figure 3: Metamodel for Quantification of the revenue leakage

The approach with metamodel of Figure 3 can fix the actual problems, but does not provide the reasons of the revenue loss. Like pouring water in a bucket with a whole it is not detecting and cleaning the root cause.
By choosing a metamodel that supports both, analyzing the data in order to find the origin of the problem and reflecting the structure of the data, a much more effective measure is the outcome.
In this case the one-to-many relations become many-to-many relations, since referential integrity problems between the keys are possible (see Figure 4).

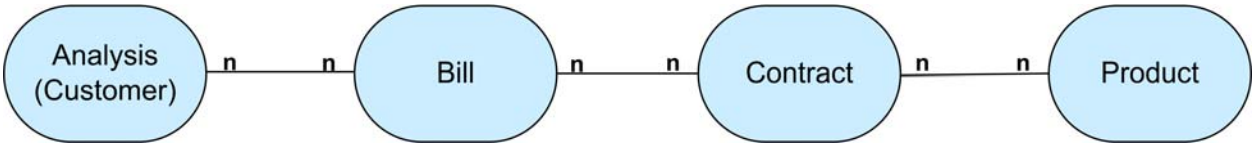

Figure 4: Metamodel for Revenue Assurance at ET

The next step is to clean the actual effected data. For that, detailed reports with the information of the actual incorrect and the proposed correct state of the data are created and updated in all of the relevant systems.
The progress of cleaning can be monitored by executives with a provided dashboard, which presents the results of KPI up to date on high level. Thus executives can watch the improvement on both, the data quality and the revenue of their company.

Proactive Procedure
A proactive revenue assurance approach has the ability not only to find revenue related problems near-real-time, but also to prevent the company from originating new problems.
For that there will be an initial load of the data into the Miocon-database and then updates will be included in near-real time. At ET consistency assurance is done by message queuing, where the systems exchange messages asynchronously. These messages are used to update the analysis database. Thus the analysis database is near-real time up-to-date and since all the necessary quality criteria are implemented, occurring data quality problems are recognized on time and with a proper cleaning process are cleaned, before reaching the customer.

Defining Key Performance Indicators (KPI)
An effective and comprehensive outcome of a revenue assurance project depends essentially on the careful and complete definition of rules that measure performance. These KPI consist of both, rules intended for detecting the revenue loss and rules for finding the reasons behind the problem. Another category reflects the needs of SOX compliance. Samples of demands by the SOX legislation applied in this section are given in the appendix. A sample list of main rules and KPI's categorized according to quantification or cause-searching is shown in the next tables.

Quantification of Revenue Leakage

# Rule	Description	Involved Systems	SOX Relevance	Revenue impact
Q1	Provisioned, but not invoiced product on a contract of a bill	ProvS, BillS	Yes	Revenue Loss, Cost Leakage
Q2	Invoiced, but not provisioned product on a contract of a bill	ProvS, BillS	Yes	Revenue Opportunity

Analysing the problem and finding the root cause

# Rule	Description	Involved Systems	SOX Relevance	Revenue impact
A1	Service activated, but no billing account created	CrmS, ProvS, BillS	Yes	Revenue Loss
A2	Service activated and billing account created, but no contract of the service created	ProvS, BillS	Yes	Revenue Loss
A3	Billing closed, but service still provided	ProvS, BillS, CustS	Yes	Cost Leakage
A4	Delay in fulfilment of the service with no billing	ProvS	No	Customer Satisfaction
A5	Delay of billing	ProvS, BillS	Yes	Revenue Loss
A6	Delay in fulfilment of the service with billing already activated	ProvS, BillS	Yes	Revenue Opportunity
A7	Billing of a different product than the provided product	ProvS, BillS	Yes	Revenue Loss, Revenue Opportunity

A8	Inconsistency of customer data over the process	CrmS, CustS, ProvS, BillS	Yes	Customer Satisfaction, Revenue Mismanagement
A9	Inconsistency of billing data over the process	CrmS, CustS, ProvS, BillS	Yes	Customer Satisfaction, Revenue Mismanagement
A10	Inconsistency of contract data over the process	CrmS, AstS, ProvS, BillS	Yes	Revenue Loss, Revenue Opportunity
A11	Different correlation of customer and bill data	CrmS, CustS, ProvS, BillS	Yes	Revenue Loss, Revenue Opportunity
A12	Incomplete registration to consistency assurance	CrmS, CustS, AstS, ProvS, BillS	Yes	Customer Satisfaction
A13	Duplicates of customer data	CrmS, CustS, ProvS, BillS	Yes	Customer Satisfaction
A14	Incorrect duplicates of products	CrmS, AstS, ProvS, BillS	Yes	Revenue Opportunity

Rating Problems

# Rule	Description	Involved Systems	SOX Relevance	Revenue impact
R1	Call records incorrectly billed (over or under-billing)	RatS, BillS	Yes	Revenue Loss, Cost Leakage
R2	Call records incorrectly correlated	RatS, BillS	Yes	Revenue Opportunity

Within the data quality project at ET the quantification and problem-analysing rules were evaluated. These are a small sample of the actual implemented rules of which there are now over 400. Evaluating KPI like above often require several rules.
The most important thing about defining quality criteria is to be complete with respect to the purpose of the data quality analysis. Detecting and Cleaning of data quality and revenue assurance problems is only possible, when we are looking for them.

The Results

Over the duration of the project quality criteria were optimized as well as the results of the data quality evaluation were improved by cleaning the data.
At the first evaluation of data quality with respect to revenue assurance, 4% of all billed contracts showed an underbilling problem. This summed up to a monthly revenue loss of several million Euros. Sample Scenarios of the reasons of these problems and the chosen correction are given in the next section.

Sample Scenarios

Title	**Category**	**Rule**
Incorrect Transfer of the legacy Product Structure to the actual Product Structure	Analysis of Product Data	A5
Description Introducing a new process including a new product structure, problems with the billing of special contracts arose.		
Root Cause After analysing the contracts in both, the legacy and the actual asset system, a problem at the transfer of one product structure to the other was found. In special cases, the date of product was set wrongly. This caused problems with billing, since then no valid or a not provisioned product was in the data.		

Correction
Since the legacy system is not yet shut down, correct dates were re-migrated into the asset system. The transfer defect was disposed.

Title	**Category**	**Rule**
Incorrect Consistency Assurance	Consistency Assurance	A12
Description		
While invoicing special active products on a bill, that bill was incorrectly closed. Customers got a closing statement without having cancelled the asset.		
Root Cause		
The customer system, responsible for customer consistency assurance, was lacking information about special active products on a bill.		
Correction		
Repairing the already incorrectly closed bills was very difficult. The bill had to be reactivated in the customer system and then re-migrated into the billing system.		

Title	**Category**	**Rule**
Customer Duplicates	Analysis of Customer Data	A13
Description		
In several systems containing customer data both, key and content duplicates of customers occurred. This caused problems with the change and order management of these customers		
Root Cause		
By comparing the customer data (customer keys, name and address) of all the systems the following cause was found. Since every system holds the complete address data, differences of address contents came up and by a intolerant search at the address system duplicates were generated.		
Correction		
The customer keys were merged to a second customer key and the result was maintained in all affected systems. The addresses were consolidated and maintained in all affected systems.		

Reasons of Revenue Loss

Reasons of revenue loss are often complicated to find and complementary. Figure 5 shows the collection of reasons found at the data quality project. Because of the cleaning process the priority order of all reasons changes periodically.

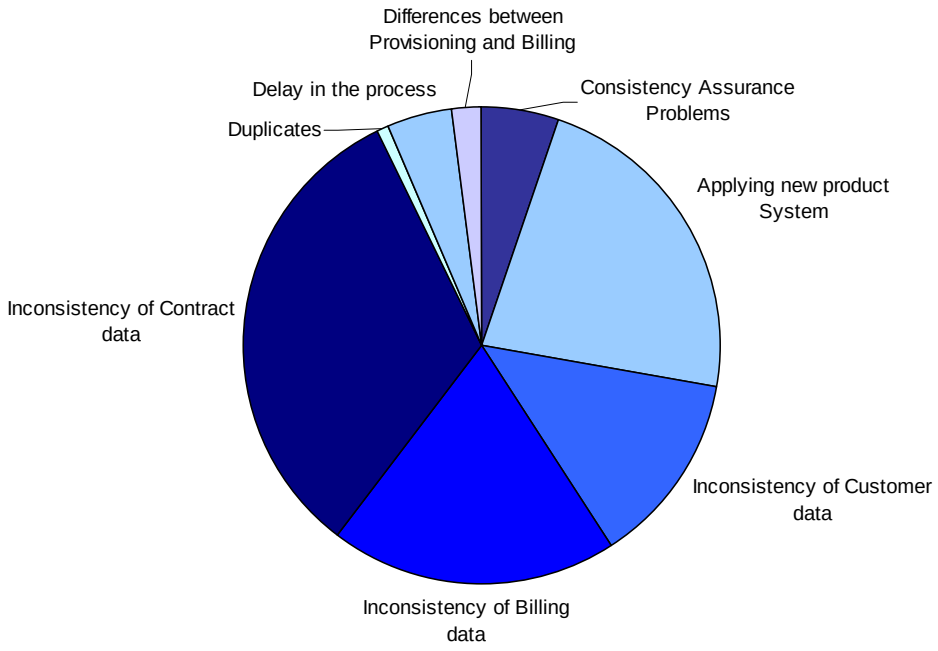

Figure 5: Reasons of Revenue Loss in ET

Inconsistency of Customer, Billing and Contract Data
Quality criteria which are based on customer, billing or contract data
Inconsistency on keys or contents inside one system or between several systems holding customer data
Duplicates
Detecting multiple occurrences of customer or product data
Delay in the process
Processing of provisioning or billing at a delayed date
Differences between Provisioning and Billing
Processing of different correlations in provisioning and billing between customer, bill and product
Consistency Assurance Problems
Partly or no registration to consistency assurance in one or several systems
Applying new product System
Wrong transfer of the legacy product structure into the new product structure

Finding the reasons of revenue loss or opportunity is an iterative process. After finding the problems, we looked at sample customers and tried to find the reasons particularly. Applying these to the KPI's, led to other sample customers with different reasons.

CONCLUSION

For companies listed at a US stock exchange, revenue assurance is not only necessary and important, but regulated by the Sarbanes-Oxley Act of 2002. One result of a revenue assurance project using data quality methods is the actual revenue loss in money terms. This encourages executives to invest into the required data quality methods. These methods optimized the data quality at the telecommunication company, also in respect to revenue-related issues.

The first count of monthly revenue loss of several million Euros shows the importance of installing a proper cleaning process for fixing the actual problems and of using proactive data quality methods for preventing the occurrence of new problems.
However finding all reasons of a problem keeps a challenge and forces a dynamical quality criteria catalog and a flexible tool for implementing the changes on time.

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APPENDIX

Sample list of demands by the SOX legislation:

- Ensure that all collected events are processed according to established filtering rules
- Ensure that duplicated records are identified, labelled and analyzed.
- Ensure that customer information items stored in different internal data sources are synchronized or regularly reconciled.
- Ensure that all payments made and received for telecom services are properly allocated to customer or service partner accounts within proper period.
- Ensure that external customer information is regularly verified against internal customer information.
- Ensure that usage records are obtained from each service partner and reconciled with internal records whenever applicable to verify accuracy of service partner invoice.
- Ensure that all billable usage records from service partner are processed and billed according to the billing rules consistent with existing contracts.
- Ensure accuracy of service fees and charges classification to enable proper matching of revenues and expenses.