Revenue Assurance Guidebook

Measuring the Impact of RA

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Table of Contents

List of Figures

List of Tables

Executive Summary

Measuring the impact or contribution of Revenue Assurance activities is a common practice. It is done to justify budgets, evaluate projects' ROI, and measure Revenue Assurance departments' performance. Nevertheless a standard widely accepted method of measuring the impact has not evolved; this lead to a chaotic situation, which in some cases resulted in mistrust. This document offers a set of well defined methods and metrics for measuring the impact of revenue assurance. These methods are based on the experience of many companies, and were tested and refined in two Catalyst projects.

It is important to emphasize that there is no "exact" formula that can give an absolute value to the contribution of Revenue Assurance activities to the CSP. The value of the contribution depends on the goals of the organization. The emphasis of one CSP can be increasing margins, while the emphasis of another CSP might be increasing customer satisfaction. Each of these two operators will put a different value to a revenue assurance activity that resulted in detecting overbilling. In the absence of this silver bullet formula, this addendum proposes a set of well defined metrics, that measure the impact of RA in different ways. CSPs are encouraged to use multiple metrics and to assign them relative importance according to the CSP's specific reality.

This addendum presents two independent models for measuring the impact of RA, the first one is based on extrapolating the value of evidences, e.g. of the leakage caused by a revenue leakage incident. The model measures the contribution of active, reactive, and proactive RA activities, considering revenue leakages, cost leakages, opportunity loss, and overcharging; it reflects both direct impacts, such as out-of-pocket spending, as well as indirect impacts such as reputation lost, legal and regulatory proceedings, cost of cash, etc.

The second model is based on the Revenue Assurance Risk Coverage model, GB941-Addendum E. It is a hierarchical formalization of possible Revenue Assurance Risks affecting the Lines of Business and Business Processes. Each risk is represented by the Likelihood that the risk will materialize, and the financial Impact of the Risk in case it materializes. Revenue Assurance controls and activities mitigate risks. The second model measures the financial impact of the risk mitigation. The model provides a unified methodology, regardless of whether the Revenue Assurance controls applied were Reactive, Active or Proactive.

The combination of both independent models provides a sound, well balanced, methodology for measuring the impact of Revenue Assurance.

1. Introduction

Measuring the impact or contribution of Revenue Assurance activities is a common practice. It is done to justify budgets, evaluate projects' ROI, and measure Revenue Assurance departments' performance. Nevertheless a standard widely accepted method of measuring the impact has not evolved; this lead to a chaotic situation, which in some cases resulted in mistrust. This document offers a set of well defined methods and metrics for measuring the impact of revenue assurance. These methods are based on the experience of many companies, and were tested and refined in two Catalyst projects.

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1.1. Contribution of detecting, recovering, and preventing Revenue Assurance Incidents

When attempting to quantify the size and impact of a Revenue Assurance incident, a number of different financial measurements can be made. There will usually be a period of time between when the incident starts to occur and when it is detected. Once the incident has been detected, a root cause investigation and a revenue recovery effort can be initiated. The investigation should ultimately pinpoint the underlying cause of the problem and a solution to fix the incident can be conceived. In some situations, a temporary fix may be put in place (e.g. manual operational process) until such time as a more permanent solution can be applied.

A number of different measurements on the financial impact of this revenue assurance incident can be taken.

Firstly, the leaked revenue can be measured from the time that an incident occurs until the revenue leak is fully or partially stopped by either a temporary fix or a permanent solution. This is called the *detected leakage value*.

If this leakage is discovered by a Revenue Assurance control, it is also possible to project forward in time and extrapolate what the revenue leakage would have been if that revenue assurance control was not in place and the issue was noticed by other operational procedures. This is called *projected revenue leakage*.

Some of the detected leaked revenue may be recoverable through manual intervention so that it can actually be billed. The amount of the detected revenue leakage that is successfully recovered is termed the *recovered leakage value*.

Finally, it is possible to measure the *prevented leakage value*. This is the amount of revenue that was prevented from leaking due to the early detection and correction of the underlying issue. This can be a combination of the savings from the projected revenue leakage that was averted and also future savings due to improvements in controls or business processes implemented as part of the solution which will prevent or reduce future leakage due to re-occurrences of the same issue.

The revenue assurance impact in limiting the effect of an incident can be measured in terms of:

- prevented leakage due to early detection of the incident by an RA control
- recovery of some or all of the losses
- other contributory factors such as business improvement, limiting of brand damage, legal costs, etc.

1.2. Revenue Assurance Incident Types

The Revenue Leakage Framework and Examples (GB941 Addendum D) discusses revenue assurance incidents in terms of revenue leakage, cost leakage and revenue opportunity loss. Each Revenue Assurance incident described in that document is categorized into one or more of these three families of financially impacting problems. Overcharging is also an important category and is treated as a distinct incident type in this document.

The four revenue assurance incident types used in RA impact measurement are described below.

Revenue Leakage

A revenue leakage in this context refers to situations where a chargeable event occurred which should have been billed to a customer or operator at a certain rate, but was not, or was charged at a lower rate. The amount of revenue leaked can be detected and reported. Also, the amount of this leak which was actually recovered through some reactive initiative can be measured and reported. Finally, a projection can be made on the averted revenue losses that were made through early detection and resolution of this issue.

Cost Leakage

A cost leakage relates to overpayment of costs for chargeable services to a third party. In many cases, these costs refer to situations where the CSP is incurring third party costs which are not being covered appropriately by customer revenues. For example, when a service is provisioned such that third party costs are activated, but the CSP has not activated the service for the subscriber or overpayment of an interconnect partner or sub-optimal use of their service.

Cost leakage can also include some indirect costs associated with the effort of correcting the root cause of a leakage incident, such as an element of increased cost when trying to rectify revenue assurance issues (see out-of-pocket spending below). Cost leakage can also involve errors in call routing where the least cost route is not available or selected correctly resulting in higher than planned costs to deliver services with fixed revenues.

The impact of the cost leakage in the above examples can usually be calculated accurately once the issue and its extent has been identified and investigated. The impact can generally be calculated in terms of the difference between the actual costs incurred and what the equivalent optimal costs would be. In most cases, cost leakages are not recoverable but in cases where they are, the recovered reduction in costs can be measured and reported. Improvements made to address cost leakages can also be projected forward using a similar technique to revenue leakages.

Revenue Opportunity Loss

Loss of revenue opportunity relates to the situation where a business policy is in place to set pricing levels, but these are either set at negative or unintentionally low margin levels or the situation where a revenue assurance artificially limits the revenues that can be generated from a subscriber. A number of opportunity loss issues result from incorrect or slow provisioning.

This can happen when a customer is unable to use a service for a longer-than-expected period of time from ordering to activation. During this delay, the CSP loses a revenue generation opportunity while the customer is unable to use the requested service. Other opportunity losses include inefficient use of assets, e.g. leased line circuits which has been released by customers but not marked as available for re-sale. ByPass fraud is also an opportunity loss as it allows parties to use services on the network that would otherwise be billed at higher rates. Any service that has an outage that results in customers not being able to use that service can result in revenue loss due to non-use of that service, customer unhappiness and even churn.

The exact measurement of the impact of an opportunity loss depends on the specific issue encountered, but in general the amount of lost revenue due to service unavailability can be estimated based on expected revenues had that service been available at that time or had that issue not occurred. In some cases where issues result in churn, the opportunity loss can be measured in terms of projecting lost revenue based on ARPU for those customers for some predefined period into the future.

There are indirect impacts to be considered also. These are outlined below (e.g. cost of calls to customer care, costs of any goodwill gestures required to placate upset customers).

Overcharging

Overcharging customers generally relates to incorrect rating whereby calls or services are charged at too high a rate or where customers are charged for items that they should not have been. Overcharging can be a serious matter for CSPs if discovered by their customers or by the regulator.

Overcharged customers need to be refunded and in some cases further compensated. Extra costs can result from increased calls by customers to customer care or by proactive customer care calls and good will credit notes to affected customers. Regulators can impose fines if the overcharging incident is serious enough, possibly resulting in churn, brand damage and loss of customer confidence if the problem becomes widely publicized.

The impact of a revenue assurance incident can be measured directly in terms of these four types of incidents and also additionally measured according to some other contributing factors as described in the next section.

1.3. Different types of contributions

The impact measurement for reactive revenue assurance is calculated using a formula based on a series of inputs and a projection. The same basic formula is used for all four incident types but the inputs differ based on the specifics of each situation.

The impact calculation is primarily based on the value that an RA control brings via damage limitation due to the early detection of incidents and on reactive revenue recovery efforts. The impact measurement model presented in this document allows for two types of calculations: simplified impact measurement which just includes direct considerations, and full impact measurement which includes a variety of secondary indirect impacts.

There are a number of indirect considerations that should be assessed when estimating the impact of RA incidents. The specific considerations will change depending on the incident type and the scale of the issue. Not all of these will be applicable for every incident. A menu of possible indirect considerations for any incident type is presented below. These extra considerations are termed secondary, not because they are of lesser importance, but mainly because they are in many cases difficult to accurately measure and their effect is indirect.

Out-of-Pocket Spending

This refers to extraordinary spending needed to rectify a revenue leakage or deal with its consequences. Typically when a leakage is discovered, an unscheduled reactive effort needs to be made to fix and recover from the issue. This extra cost may be due to efforts to recover leaked revenue, efforts to investigate the underlying cause of a problem, goodwill gestures to pacify or compensate customers who have been inconvenienced, or to create a temporary or permanent solution. This type of cost could be measured in terms of the cost of time and effort spent in investigation and rectification of the issue and in other associated costs.

Reputation Loss (branding)

Reputation loss ensues when parties outside of the CSP become aware of revenue assurance issues. This is especially true when customers are directly impacted and/or the media publicizes the issues. Typical issues involving reputation loss and customer dissatisfaction include overcharging, incorrect billing, service unavailability,

etc. This type of impact is very difficult to isolate and assign a monetary value to on an issue-by-issue basis. Perhaps marketing departments can measure the brand impact of specific issues using some non-arbitrary techniques.

Legal and Regulatory Proceedings

Certain types of revenue assurance issues such as overcharging, incorrect billing, and service unavailability can result in a government regulator becoming involved. This has a number of undesirable impacts and costs. Regulators can impose direct fines on CSPs, bring the issues to the attention of the media (see reputation loss above), and request intensive and immediate investigations and reports into the issues. Regulatory (and other legal) proceedings have a high cost in terms of resources needed to deal with the formal proceedings and direct fines imposed for any perceived breaches in regulatory rules. The effort spent in such proceedings should be measureable as should any financial penalties imposed. Both of these costs can be aggregated to determine the impact of these issues.

Cost of Cash

A delay in issuing invoices and in receiving payment for services that have already been delivered has a potential cost in terms of reduced cash flow. Any leakage, even if recovered later, can have an impact if payment for that leakage is received later than it would normally have been. If the leakage is significant, a percentage for the cost of cash can be selected and the impact calculated as this percentage of the delayed revenues.

Business Improvement

Revenue Assurance activities can result in improvements to business processes. An improvement in a business process can have a positive impact and prevent future revenue assurance issues. Business improvements that enhance operational efficiency and reduce cost have a positive impact. Each type of improvement could have its own mechanism for calculation of its impact.

For example, improvements that allow a CSP to issues bills sooner could see an impact calculated in a similar way to the cost of cash. Improvements that enhance operational efficiency so that less effort is required to perform specific tasks can be measured in terms of a reduction in effort.

Avoided Leakage

Any leakage which is avoided through some proactive effort prevents lost revenues and should be quantified and reported in some financial way. When a new or improved revenue assurance control is activated that can detect new kinds of leakages quickly, there is an impact in terms of averted future losses. The measurement of the impact of these averted losses is indirect and can be projected as explained in the previous section.

Proactive efforts like pre-launch revenue assurance testing and coverage also avoid leakages before new services go live in production. This can be measured by, for

example, measuring the revenue impact of issues found during pre-launch testing and projecting them forward. Alternatively, a standard expected percentage for revenue loss for new services without any revenue assurance controls could be applied and used as the basis for a revenue impact estimation.

1.4. Contributing by Mitigating Risk

The Revenue Assurance Risk Coverage model, GB941- addendum E, is a hierarchical formalization of possible Revenue Assurance Risks affecting the Lines of Business and Business Processes. Each risk is represented by the Likelihood that the risk will materialize, and the financial Impact of the Risk in case it materializes. From the model it is straight forward to calculate the mean financial impact of a risk (mean and not exact, because it is a probabilistic function). Risks are mitigated by controls; controls either reduce the Likelihood or the Impact of the Risk. The original Risks, before applying the controls are called Inherent Risks. The resulting risks, with reduced Likelihood and or Impact, are called Residual Risks.

It is possible to calculate the mean financial impact of a residual Risk. The difference between the mean financial impact of an inherent risk and the mean financial impact of the corresponding residual risk, the same risk after applying the RA controls, measures the impact of Revenue Assurance controls. This method for calculating the impact of Revenue Assurance provides a unified methodology, regardless of whether the Revenue Assurance controls applied were Reactive, Active or Proactive.

2. Measuring the impact of Reactive & Active RA

Many Revenue Assurance operations have traditionally measured their impact and contributions to the business and its margins in terms of the value of the revenue that they recover. According to this model, if the value of the revenue that they detect and recover is greater than a specific target, then the Revenue Assurance function has performed well.

As the revenue assurance practices in an operator matures, leakages should become less prevalent and the amount of detected and recovered revenue may diminish significantly. This is a problem for revenue assurance teams who are measured and justified purely in terms achieving revenue recovery targets. This document seeks to provide a model for the measurement of the revenue assurance impact in terms of revenue recovery, but also in terms of a number of other measurements. This section describes a framework for impact assessment of active and reactive revenue assurance. Subsequent sections provide frameworks for the impact of proactive revenue assurance and risk reduction activities.

A revenue assurance function can be measured in terms of the impact of the reactive and active RA work it performs. Active RA controls should ensure that incidents are detected quickly and the extent of the detected incidents should be apparent from the controls in place. Many RA controls can detect the incidents and also provide information on the scope of the incidents in terms of which services are affected, for which time periods, and perhaps what numbers of subscribers are affected. This information should provide enough data to accurately estimate or make a projection of the size of a detected incident (e.g. how much revenue or cost has leaked to date).

Next, a reactive effort will be undertaken to recover any recoverable revenue and perform a root cause analysis on the underlying issue causing the leakage. The revenue recovery process can report on how much leaked revenue it managed to recover and bill.

Finally, it will be possible to project the potential leakage or loss for the detected issue had it not been discovered by a revenue assurance control and was allowed to persist until it was found by another operational process. This amount can be considered as part of the potential saving (averted loss).

The problem, then, to be solved is how to equate and report the revenue impact of incidents in terms of how much revenue or cost is being detected as leaked, recovered and also the revenue impact in terms averted losses due to early incident detection.

The methods of how these values are measured and equated may differ depending on the leakage type or "family of leakages" and which contributing factors are taken into account.

2.1. Different treatment to different families of leakages

This document provides different calculation guidelines for measuring the impacts based on the type of leakage. Three leakage types are defined by the Revenue Leakage Framework and Examples (GB941 Addendum D) and overcharging is additionally included for RA impact measurement:

- Revenue leakage
  - Mainly includes non-billing or under-billing of services
  - E.g. C.12 "CDRs not written to network element data file"
- Cost leakage
  - Includes issues such as stranded assets, over payments, over/under allocation, under payments,
  - E.g. B.5 Third party costs of orders on hold, B.21 Stranded assets.
- Revenue opportunity (and loss thereof).
  - Denial of service, stranded assets, under allocation
  - E.g. Delays in processing orders and provisioning (B.4, B.8, B.16), Third party costs for cancelled circuits.
- Overcharging
  - Over-rating usage, inclusion of incorrect charges on a customer bill
  - E.g. charging for each MMS twice (D.26), over-rating a voice call (D.13), over-calculation of tax (D17).

This document presents a generic formula to calculate the impact of incidents of the above types. The inputs to the formula will be different based on the incident type and the specifics of that incident.

Some leakage issues have elements from more than one leakage type. The person calculating the RA impact can choose the formula from the most relevant leakage type for the particular RA issue that they are measuring.

The contributing factors for each type will be different also. These are explained in the below sections.

2.2. Reactive RA Impact of Revenue Leakage

Revenue Leakage involves under-billing or failing to bill for a service. Assuming that an RA control is in place that detects a revenue leakage, a number of measurements can be taken to quantify the cost of that leakage and the positive financial impact of RA in the early detection of that leakage. Some specific measurements are outlined below. The following details assume a certain sequence of events as follows (though not necessarily in the below order).

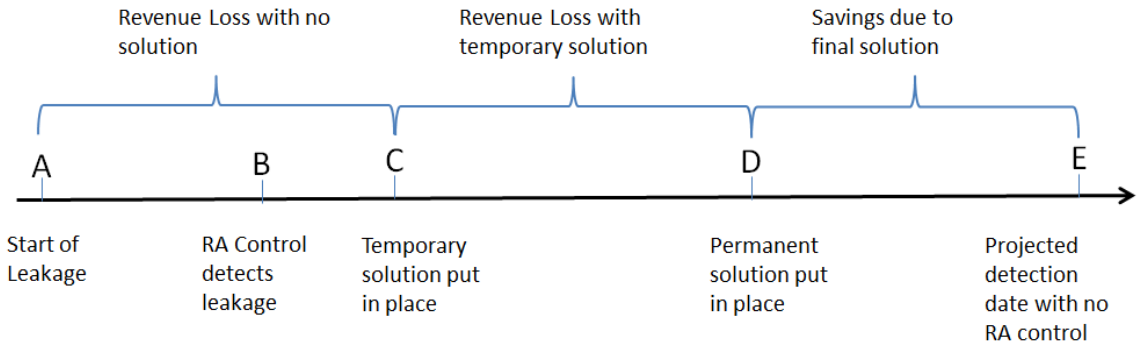

Figure 1 – Revenue Leakage for Reactive RA

1) Leakage starts to occur (A)
2) Leakage is detected by RA control (B)
3) Temporary fix is put in place to prevent or limit future leakage, if applicable (C)
4) Revenue Recovery efforts are made to recover leakages between A and D, if applicable
5) Final solution is put in place to stop the leakage (D)
6) Projected date to when the leakage may have been detected by other means than the RA control (E)

Variable Measurements

A) Leakage Size (value) before temporary solution ($RvLoss_{A-C}$)

Once the leakage has been detected it needs to be quantified to assess its extent. Usually it is possible to determine how long the problem has been in existence for and how much overall revenue leakage has resulted until the point that a temporary or permanent solution is put in place. The RA control and subsequent impact investigation may directly report the start date for the leakage and the amount of

leaked revenue. If not the cost may need to be calculated or estimated based on the information reported by the RA control for this leakage and other relevant data sources.

It also needs to be decided if this leakage is a once off event or is recurrent (maybe the issue existed before the control was put in place). If the leakage is thought to be recurrent, the leakage size should incorporate all re-occurrences of the leakage (based on a relevant start date). Also, if the leakage was detected based on sample or partial data and not a full data set, some element of projection will be needed to project how big this leakage will be for the full data set.

B) Length of time for leakage before temporary solution ($TLoss_{A-C}$)

This is the period of time from when the leakage started and when the first temporary or permanent solution was put in place. The RA control may report this period of time itself or it may need to be determined or estimated as part of an RA impact investigation. If the actual date that a problem started is known, then this value should be used. If not an estimation needs to be made. In cases where the problem is thought to be recurrent, a relevant start time should be estimated.

One industry practice for the estimation of the start time is to use the earliest point for which the existence of such leakage is evident. An alternative, in order to avoid costly investigations, is to use typical values for **$TLoss_{A-C}$** based on the type of leakage.

Other factors can be used to modify these typical values e.g. if 90% of the revenues of a service are being leaked, the leakage will be detected quickly with or without an RA control in place and so the estimated period should be lower than a smaller scale leakage of the same type. .

C) Leakage Size (value) during temporary solution ($RvLoss_{C-D}$)

After detection of a revenue leakage, a temporary solution may be put in place to stop or reduce the leakage. This measurement measures the leakage during the period between the temporary solution being implemented and a permanent fix being put in place. The value of this measurement will be zero if either no temporary solution was put in place or the temporary solution prevented all further revenue leakage for this problem.

D) Projected Leakage Detection Time (with no RA control) ($TLoss_{A-E}$)

This measure seeks to estimate how long the leakage would have persisted had the RA control not detected it. In many cases a leakage may be detected in the future by some other operational, investigative, accidental or auditing process. For each detected leakage, a projected detection time based on having no RA control in place needs to be estimated. In cases where it is difficult to estimate this, an agreed default period can be used (e.g. 12 months). This measurement should cover the time from when the leakage is detected to have begun until when it would have been found without an RA control.

Some operators have their own internal agreements and guidelines for projection periods for RA impact measurement purposes. These differ from operator to operator and in many cases are heavily influenced by the type of problem encountered Incidents relating to incorrect charging may be detected or implicitly fixed during the next scheduled set of rate plan changes.

Leakages that have existed for extended periods of time before a new RA control detected them would most likely have persisted for a longer time. Very severe incidents or outages may have been detected very quickly without RA intervention via customer care complaints or normal operational processes; it does not make sense to project the impact of these problems for many weeks into the future.

Operators may choose to use typical values for this time period based on the incident type. Other factors can be used to modify these typical values. For example, if 90% of the revenues for a service are being leaked, the leakage will be detected quickly with or without an RA control in place and so the projection period should be lower than a smaller scale leakage of the same type.

E) Recovered Amount (RvRecover)

Once a leakage is detected, it may be possible to recover some of the leaked revenue though reactive efforts. This measure seeks to quantify the actual recovered and successfully billed revenue that was originally leaked.

F) Recovery Cost (CostRecovery)

This measure covers the costs of recovering the leaked revenue. These costs may be in time and effort but need to be translated into monetary values for this measure.

G) Cost of Temporary and Permanent Solution (CostSoln)

This measure covers the cost of performing the root cause investigation and the costs for implementing a temporary (if applicable) and permanent solution to rectify the root causes of the leakage.

Note: The measure of these items can be important for the RA department to create a business case to justify investment in permanent solutions for incidents that might reoccur. In many cases, having to implement temporary solutions and recover leaked revenue is very time consuming, resource demanding, and does not guarantee full revenue recovery. In situations where these costs are high and where they may be incurred on a regular basis, they can be used to justify a permanent solution that will negate the need for reactive intervention.

H) Indirect Impact before temporary solution ($IndirectImpact_{A\text{-}C}$)

There can be some additional indirect impacts associated with different kinds of revenue leakages such as cost of cash (for delayed recovery of revenue) and out-of-pocket spending additional to the recovery and solution costs noted above. These

indirect impacts can be considered as secondary costs due to a number of indirectly related issues resulting from the root cause of the primary leakage.

In most cases, costs like reputation loss or regulatory costs are not applicable as these leakages generally do not negatively impact customers and third parties. Some of these indirect impacts may apply occasionally e.g. where the effect of delayed recovery efforts becomes apparent to third parties. In most cases the indirect impact for Revenue Leakages will be set to zero for the purposes of impact assessment for active and proactive RA. This measure covers the value associated with the indirect impact for the period from when the leakage started and when the first temporary or permanent solution was put in place.

I) Indirect Impact during temporary solution ($IndirectImpact_{C-D}$)

After detection of a revenue leakage a temporary solution may be put in place to stop or reduce the leakage. This measurement measures the indirect impact during the period between the temporary solution being implemented and a permanent fix being put in place. The value of this measurement will be zero if either no temporary solution was put in place or the temporary solution prevented all further indirect impacts for this problem.

Active and Reactive Revenue Leakage Impact Formula

The following formulae can be used to measure the impact of a leakage and the impact RA has on that leakage in terms of revenue saving:

Actual Leakage Value with RA control in place ($RvLossActual_{A-D}$)

This formula is used to calculate the revenue loss that was detected between the start of the problem and when it was resolved. It assumes that an RA control detected the problem and accounts for the situation where a temporary solution may have been put in place before the final resolution to the underlying problem that may reduce or eliminate the leakage for a period of time before final resolution.

$$RvLossActual_{A-D} = RvLoss_{A-C} + RvLoss_{C-D}$$

Projected leakage with no RA control in place ($RvLossProj_{A-E}$)

This formula is used to calculate what the revenue leakage might have been had the RA control not been in place and the problem was finally detected by some other means. It is calculated based on an average leakage value per period of time (day, week, month) that was actually experienced during the active leakage period (A-C) which is then projected forward a number of periods of time into the future.

$$RvLossProj_{A-E} = (RvLoss_{A-C} / TLoss_{A-C}) * TLoss_{A-E}$$

Actual Indirect Impact ($IndirectImpact_{A-D}$)

This formula is used to calculate the indirect impact that was detected between the start of the problem and when it was resolved. It assumes that an RA control detected the problem and accounts for the situation where a temporary solution may have been put in place before the final resolution to the underlying problem that may reduce or eliminate the leakage for a period of time before final resolution.

$$IndirectImpact_{A-D} = IndirectImpact_{A-C} + IndirectImpact_{C-D}$$

Projected indirect impact with no RA control in place ($IndirectImpactProj_{A-E}$)

This formula is used to calculate what the indirect impact might have been had the RA control not been in place and the problem was finally detected by some other means. It is calculated using a similar technique to the projected revenue leakage.

$$IndirectImpactProj_{A-E} = (IndirectImpact_{A-C} / TLoss_{A-C}) * TLoss_{A-E}$$

Simplified RA Impact (RAImpactSimple) - SRAI

This formula provides a simple formula that can be used to calculate the impact of RA. It is based on two factors:

- the difference between the actual revenue loss with an RA control in place and the projected revenue loss without the same RA control; and
- the value of the recovered revenue.

Note that if the underlying problem is not fixed (e.g. because it's not cost effective or was a once off error), the actual and projected revenue leakages should be the same and the impact will be purely based on the recovered revenue.

$$RAImpactSimple = RvLossProj_{A-E} - RvLossActual_{A-D} + RvRecover$$

Full RA Impact (RAImpactFull) - FRAI

This formula provides a more complete model for RA impact assessment based on the result of the simple RA impact calculation and taking into account the contributing financial effect of projected indirect impacts.

$$RAImpactFull = RAImpactSimple + ProjIndirectImpact_{A-E} - IndirectImpact_{A-D}$$

The indirect impact for Revenue Leakage can include a number of factors as explained above including cost of cash, reputation loss, and regulatory/legal costs. In many cases they will be zero or negligible and can be omitted. The values used for the indirect impact may need to be subdivided into those that it is valid to project forward (as they have a recurring impact) and those that it is not.

Reduced RA Impact (RAImpactReduced) - RRAI

This formula (while itself simple) provides a more complicated model for RA impact assessment based on the result of the full RA impact calculation and taking into account additional costs such as the cost of the solution to fix the issue.

RAImpactReduced = RAImpactFull - CostRecovery – CostSoln

It is debatable whether RRAI is really meaningful, i.e. whether the cost of the solution should be included in the impact measurement. It may not make sense to include it in the impact assessment if the issue was found by some non-RA means and fixed, i.e. the cost of the solution is incurred irrespective of whether an RA control found the issue.

If, however, the issue would have eventually rectified itself without any effort to implement a solution (at point E), then it could make sense to include this cost in the impact. Nevertheless, since some CSPs today use similar measurements, for completeness it has been included and a well-defined formula for its calculation has been specified.

2.3. Example Revenue Leakage Calculation for Reactive RA

The following provides an example of how the above formulae can be used to measure the impact of RA for a specific leakage.

Assume there is a revenue leakage due to the under rating of off-net call records at peak hours for subscribers on a specific postpaid tariff plan. The issue was due to a lower than desired rate being set for this type of call for a single specific tariff plan. This error was introduced during an update of rate plans in January of that year so it is not considered a recurrent issue prior to the time periods reported below. An RA control which checks samples of call records detects this issue after the control has been implemented to check this problematic tariff plan. The leakage has the following characteristics:

- Leakage started in January (A)
- Leakage was detected in March (B is 4 weeks after A)
- Tariff plans were corrected in March which rectified the incorrect rating issue and no temporary solution was needed (C and D are both 1 week after B)
- This issue would have gone undetected until the next tariff plan update scheduled for June (E is 8 weeks after A)
- Revenue Recovery was possible for the 80% of the leakage for the 4 weeks that preceded the solution (D).
- The detected leakage was 1,000 USD per week for 5% of the subscribers that the RA control sampled for this tariff plan. Projecting this for the full set of subscribers on this tariff plan would suggest that the full losses are 20,000 USD per week.

The measurements are provided by the RA control and subsequent RA investigation into the severity of the problem are shown in the below table.

Variable	Value	Comments
Leakage Size (value) before temporary solution (**$RvLoss_{A-C}$**):	80K USD	20K per week for 4 weeks
Length of time for leakage before temporary solution (**$TLoss_{A-C}$**):	4 weeks	
Leakage Size (value) during temporary solution (**$RvLoss_{C-D}$**):	0	No temporary solution implemented
Projected Leakage Detection	8 weeks	

Time (with no RA control) (**$TLoss_{A-E}$**)		
Recovered Amount (**RvRecover**)	64K USD	80% of 4 weeks of leakage = 4 * 20K * 80%
Cost of Temporary and Permanent Solution (**CostSoln**)	10K USD	Based on effort for rating engineers to investigate issue, rectify the rate plans and test the new changes
Indirect Impact (**IndirectImpact**)	0K USD	No additional indirect impacts.
Recovery Cost (**CostRecovery**)	5K USD	Based on effort to identify incorrect CDRs and re-rate and re-bill them

Table 1 – Revenue Leakage for Reactive RA

The measurement values in the above tables are then applied to the RA impact formulae as shown in the following table.

Impact Value	Generic Formula	Calculation	Result
Actual Leakage Value with RA control in place	***$RvLossActual_{A-D}$= $RvLoss_{A-C}$+ $RvLoss_{C-D}$***	80K + 0K	**80K USD**
Projected leakage with no RA control in place	***$RvLossProj_{A-E}$= ($RvLoss_{A-C}$/ $TLoss_{A-C}$) * $TLoss_{A-E}$***	(80K / 4 weeks) * 8 weeks	**160K USD**
Simplified RA Impact - SRAI	***RAImpactSimple = $RvLossProj_{A-E}$ - $RvLossActual_{A-D}$ + RvRecover***	160K – 80K + 64K	**144K USD**

Full RA Impact - FRAI	***RAImpactFull = RAImpactSimple - ProjIndirectImpact$_{A-E}$ - IndirectImpact$_{A-D}$***	144K + 0K – 0K	**144K USD**
Reduced RA Impact - RRAI	***RAImpactReduced = RAImpactFull - CostRecovery – CostSoln***	80K – 5K – 10K	**129K USD**

Table 2 - Revenue Leakage for Reactive RA with formulae

2.4. Reactive RA Impact of Cost Leakage

A cost leakage relates to overpayment of costs for chargeable services to a third party. This overpayment of costs may be due to under-utilization of resources that bear third party costs. The impact measurements for cost leakages are very similar to those for revenue leakage and the above section should be read before this section in order to get a fuller understanding of some of the concepts and measurement techniques used.

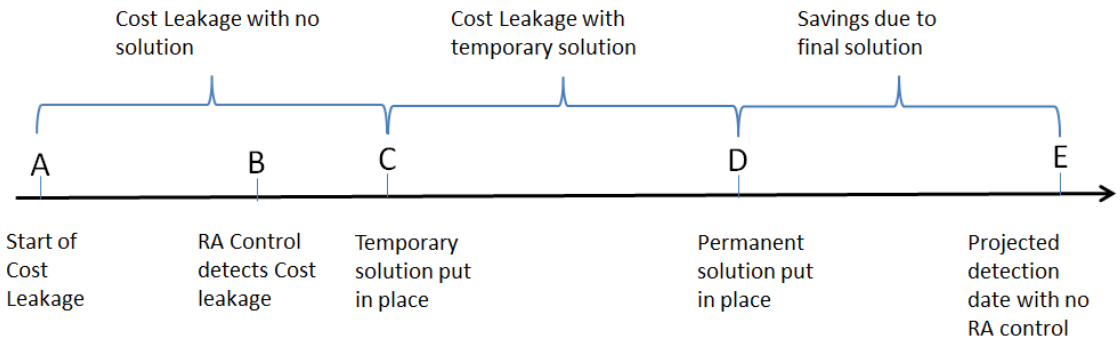

Figure 2 – Cost Leakage for Reactive RA

The order of events for a cost leakage issue follows the same pattern as that of a revenue leakage issue.

1) The Cost Leakage starts to occur (A)
2) The Cost Leakage is detected by RA control (B)
3) Temporary fix is put in place to prevent or limit future cost leakage, if applicable (C)
4) Cost Recovery efforts are made to recover leakages between A and D, if applicable
5) Final solution is put in place to stop or improve the cost leakage (D)
6) Projected date to when the cost leakage may have been detected by other means than the RA control or ceased to exist (E)

The variables to measure and the formulae to apply for Cost Leakage are the same as for Revenue Leakage. Please refer to the previous section for the description of this. There are a few nuances on the measurements that need to be taken for Cost Leakages which may differ from how Revenue Leakages are measured. These are discussed below.

Variable Measurements

A) Leakage Size (value) before temporary solution ($RvLoss_{A-C}$)

The measurement of the extent of the cost leakage will follow similar guidelines to that of a revenue leakage. If the detected leakage is an occurrence of a recurrent problem, then the leakage size should be increased to cover the full extent of all suspected occurrences.

Also if the issue was detected based on an RA control that samples a full data set, the report leakage size should represent the full extent of the problem in the complete data set either though exact calculation or some representative projection.

B) Length of time for leakage before temporary solution ($TLoss_{A-C}$)

As per Revenue Leakage scenario.

Please refer to the discussion in section 2.2 B for advice on selecting suitable values for this time period when the actual value is not available or difficult to accurately measure.

C) Leakage Size (value) during temporary solution ($RvLoss_{C-D}$)

As per Revenue Leakage scenario

D) Projected Leakage Detection Time (with no RA control) ($TLoss_{A-E}$)

As per Revenue Leakage scenario.

Please refer to the discussion in section 2.2 D for advice on selecting suitable values for this time period when it is not obvious what value to use.

E) Recovered Amount (RvRecover)

Depending on the type of cost leakage, it may or may not be possible to retrieve some of the lost costs. In the case where a CSP has overpaid a third party, the recovery may involve contacting the third party for re-imbursement or getting a credit against future costs. In some cases (e.g. poorly designed contract with a third party), the cost leakages cannot be stopped or recovered. In this case, RA can measure the extent of the issue based on past leakages and projected future leakages. If the RA process detected and highlighted that poorly designed contracts were leading to cost leakages, the permanent solution date (D) could be considered to be the end of the inefficient contract with a projected non-RA detection date (E) projected for the duration of the following contract.

F) Recovery Cost (CostRecovery)

As per Revenue Leakage scenario if recovery is applicable.

G) Cost of Temporary and Permanent Solution (CostSoln)

The costs for a permanent solution may need to consider not only the IT and operational costs of the problem resolution but also other topics like legal and marketing departments where contracts and offers need to be revisited.

H) Indirect Impacts before temporary solution ($IndirectImpact_{A-C}$)

Indirect impacts such as cost of cash may be included if applicable or significant. Impacts like reputation loss are usually not involved as these issues are typically due to internal inefficiencies which do not get reported in the public domain. In some extreme cases, brand damage could be involved. For example, if an issue with a third party supplier went to court and was widely reported.

I) Indirect Impacts during temporary solution ($IndirectImpact_{C-D}$)

As per Revenue Leakage scenario considering the applicable indirect impacts mentioned above.

Active and Reactive Cost Leakage Impact Formula

The formulae to be used here are the same as for Revenue Leakage although there may be some cost leakage specific differences in how the variables used in the formulae are measured as described above.

2.5. Example Calculation for Active RA for Cost Leakage

The following provides an example of how the above formulae can be used to measure the impact of RA for a specific cost leakage.

Assume there is a cost leakage due to an Operator activating third party services before the same services are provisioned to the subscriber. In this situation, the Operator is paying a third party for a service for the period of time between the service activation and the point when it becomes available to the subscriber (i.e. from when the subscriber can be legitimately billed for that service).

In this situation the Operator has activated the third party service too early and is unnecessarily paying for it for a period of time before it can bill its subscribers. An RA control or RA review of the service activation and subscriber provisioning process could highlight such problems and the calculation set out below demonstrates how the impact of this RA control could be measured.

- Leakage started in March (A)
- Leakage was detected in mid-April (B is 6 weeks after A)
- The service activation and subscriber provisioning processes were synchronized to remove the unnecessary cost leakage and no temporary solution was needed (C and D are both 1 week after B)
- This issue would have gone undetected for an unspecified time so a 20 week maximum period was selected (E is 20 weeks after A)
- No cost leakage recovery was possible.
- The detected leakage was 7,000 USD per week.

The measurements are provided by the RA control and subsequent RA investigations into the severity of the problem are shown in the table below.

Variable	Value	Comments
Leakage Size (value) before temporary solution (**$RvLoss_{A-C}$**):	49K USD	7K per week for 7 weeks
Length of time for leakage before temporary solution (**$TLoss_{A-C}$**):	7 weeks	No temporary solution (C = D)
Leakage Size (value) during temporary solution (**$RvLoss_{C-D}$**):	0	No temporary solution implemented

Projected Leakage Detection Time (with no RA control) (**$TLoss_{A-E}$**)	20 weeks	
Recovered Amount (**RvRecover**)	0K USD	
Cost of Temporary and Permanent Solution (**CostSoln**)	9K USD	Synchronize third party service activation with provisioning for that subscriber
Indirect Impact (**IndirectImpact**)	0K USD	No additional indirect impacts.
Recovery Cost (**CostRecovery**)	0K USD	No cost leakage recovery possible

Table 3 - Cost Leakage for Active RA

The measurement values in the above tables are then applied to the RA impact formulae as shown in the table below.

Impact Value	Generic Formula	Calculation	Result
Actual Leakage Value with RA control in place	***$RvLossActual_{A-D}$= $RvLoss_{A-C}$+ $RvLoss_{C-D}$***	49K + 0K	**49K USD**
Projected leakage with no RA control in place	***$RvLossProj_{A-E}$= ($RvLoss_{A-C}$/ $TLoss_{A-C}$) * $TLoss_{A-E}$***	(49K / 7 weeks) * 20 weeks	**140K USD**
Simplified RA Impact - SRAI	***RAImpactSimple = $RvLossProj_{A-E}$ - $RvLossActual_{A-D}$ + RvRecover***	140K – 49K + 0K	**91K USD**

Full RA Impact - FRAI	***RAImpactFull = RAImpactSimple - ProjIndirectImpact$_{A-E}$ - IndirectImpact$_{A-D}$***	91K + 0K – 0K	**91K USD**
Reduced RA Impact - RRAI	***RAImpactReduced = RAImpactFull - CostRecovery – CostSoln***	91K – 0K – 9K	**82K USD**

Table 4 - Cost Leakage for Active RA with formulae

2.6. Reactive RA Impact of Opportunity Loss

Opportunity loss manifests itself in a number of different forms, from service outages and bad provisioning to incorrect/over-billing, as well as other problems. The outcome is usually twofold:

- Direct losses: lost revenue opportunity due to internal inefficiency or inability of a customer to use a service that they should otherwise be able to access.
- Indirect losses: customer unhappiness resulting in complaints, customer care overheads, costs for goodwill gestures, reputation loss, regulatory and legal issues and even churn.

The same basic formulae for Revenue Leakage can be used for Opportunity Loss but some additional costs need to be included in the indirect impact measurement. Also, the way in which the leakage size for opportunity loss is measured will be different from Revenue and Cost leakage. These issues are outlined below.

Variable Measurements

A) Leakage Size (value) before temporary solution (RvLoss$_{A-C}$)

The calculations for leakage due to opportunity loss are not as straight forward as with revenue leakage. In many cases, subscribers will have been prevented from using a service. In this case, an estimate is required of the revenue that should have been generated if these subscribers were actually able to use that service. This measurement can be done by measuring the typical usage for that type of subscriber for the denied service and estimating the lost revenue opportunity based on that. This could be calculated for a small set of subscribers and then the full extent of the loss could be estimated by projecting this value to cover all affected subscribers.

Opportunity loss also involves the inefficient use of resources (cancelled circuits not marked for re-sale, stranded assets, bypass). As with the above example, an estimation of the revenue that could have been generated needs to be made and used as the leakage value.

In some cases, opportunity loss can lead to churn (e.g. Poor QoS leading to churn). In cases that result in churn, a leakage size can be estimated based on a multiplication of the ARPU for those customers projected forward an agreed amount of time (e.g. 12 months).

B) Length of time for leakage before temporary solution ($TLoss_{A-C}$)

As per Revenue Leakage scenario.

C) Leakage Size (value) during temporary solution ($RvLoss_{C-D}$)

As per Revenue Leakage scenario.

D) Projected Leakage Detection Time (with no RA control) ($TLoss_{A-E}$)

As per Revenue Leakage scenario.

E) Recovered Amount (RvRecover)

Revenue recovery is almost never possible for opportunity loss.

F) Recovery Cost (CostRecovery)

Not applicable (set to zero).

G) Cost of Temporary and Permanent Solution (CostSoln)

The costs for a permanent solution may need to consider not only the IT and operational costs of the problem resolution but also other topics like legal and marketing departments where contracts and offers need to be revisited.

H) Indirect Impact before temporary solution ($IndirectImpact_{A-C}$)

A number of extra costs need to be considered for inclusion in the indirect impact measurement for opportunity loss. These extra indirect impacts include:

Regulatory fines and Legal costs:

These can occur where there is an inability to provide an expected service or service level. Any fines imposed by regulators or extra legal costs resulting from the opportunity loss should be accounted for as part of the indirect impact.

Cost of goodwill gestures (discounts, credits) to affected subscribers

Where subscribers have been inconvenienced due to an opportunity loss issue and special concessions needed to be made to affected subscribers, these costs should be included as an indirect impact. As well as the actual cost of the goodwill gestures given to subscribers, the internal effort required to donate these should be included.

Cost of increased complaints of customer care

Where an issue results in customers needing to call customer care to find a resolution, there is an indirect impact in terms of the effort in the call center to take the call, and maybe also in terms of the reactive operational effort to correct the symptoms of the issue (but not necessarily the root cause of the issue).

Churn

When an issue results in churn, an indirect impact should be calculated for this (perhaps based on ARPU as above). Churn should not be included in the indirect impact if it has already been accounted for in the leakage size calculations.

Reputation Loss

This is hard to quantify financially. However, for very severe and publically known issues that affect market share or take up of new subscriptions, it can be estimated. Marketing departments may have measurement models that can quantify brand value and financially qualify the drop after a major incident.

Customer Satisfaction Loss

As with reputation loss, this can be hard to quantify accurately and financially. If customers affected by a specific issue are contacted (e.g. to apologize for an issue and make a goodwill gesture), it may be possible to gauge their level of satisfaction and determine that it is lower than it should be (e.g. based on some average for that customer type).

I) Indirect Impacts during temporary solution ($IndirectImpact_{C\text{-}D}$)

As per Revenue Leakage scenario considering the applicable indirect impacts mentioned above.

Reactive Opportunity Loss Impact Formula

The formulae to be used here are the same as for Revenue Leakage although there may be some specific opportunity loss differences in how the variables used in the formulae are measured (as described above).

2.7. Example Calculation for Active RA for Opportunity Loss

The following provides an example of how the above formulae can be used to measure the impact of RA for a specific opportunity loss scenario.

In cases where the provisioning process has problems with the provisioning of new services for existing subscribers, opportunity loss can occur. If provisioning of a service like Data is incorrect, such that the service is enabled within the billing system but remains inactive in the subscribers' network provisioning profile, the affected subscribers will be unable to access data services from their devices. This is an opportunity loss as these subscribers have requested access to the data service and are prepared to use and pay for this service, but are prevented from doing so.

A standard RA platform/provisioning integrity control could detect such problems and the calculation set out below demonstrates how the impact of this RA control could be measured.

- Leakage started in June (A)
- Leakage was detected after 1 weeks (B is 1 week after A)
- The temporary solution was designed to locate affected subscribers and manually fix their provisioning profile until the underlying provisioning process was fixed. This was done immediately upon detection (C is the same time as B)
- A permanent solution was put in place after 4 weeks (D is 3 weeks after C).
- This issue could have gone undetected and undiagnosed for up to 8 weeks (E is 8 weeks after A)
- No cost leakage recovery was possible
- The detected leakage was 1403,000 USD per week

The measurements are provided by the RA control and subsequent RA investigations into the severity of the problem are shown in the table below.

Variable	Value	Comments
Leakage Size (value) before temporary solution (**$RvLoss_{A-C}$**):	140K USD	140K per week for 1 week
Length of time for leakage before temporary solution (**$TLoss_{A-C}$**):	2 weeks	Run RA control daily to detect affected subscribers and manually fix them
Leakage Size (value) during temporary solution (**$RvLoss_{C-D}$**):	60K	Los reduced to 20K per week for 3 weeks based

		on fixing each subscriber the day after the problem occurs
Projected Leakage Detection Time (with no RA control) (**$TLoss_{A-E}$**)	8 weeks	
Recovered Amount (**RvRecover**)	0K USD	
Cost of Temporary and Permanent Solution (**CostSoln**)	30K USD	5K per week for 3 weeks during temporary fix period and 15K cost to finally repair the root cause of problems in provisioning
Indirect Impact (**IndirectImpact**)	40K USD	There were indirect costs in terms of calls to customer care for subscribers who noticed their denial of service. A goodwill gesture worth 20 USD each was made to each of these customers.
Recovery Cost (**CostRecovery**)	0K USD	No recovered costs. Damage limitation due to temporary solution already accounted for in reduced leakage size between C and D.

Table 5 – Opportunity Loss for Active RA

Note: the time values used are derived from the tables of section 2.2 B & D.

The measurement values in the above tables are then applied to the RA impact formulae as shown in the below table.

Impact Value	Generic Formula	Calculation	Result
Actual Leakage Value with RA control in place	***$RvLossActual_{A-D}$= $RvLoss_{A-C}$+ $RvLoss_{C-D}$***	140K + 60K	**200K USD**

Projected leakage with no RA control in place	***RvLossProj*$_{A\text{-}E}$*= (RvLoss*$_{A\text{-}C}$*/ TLoss*$_{A\text{-}C}$*) * TLoss*$_{A\text{-}E}$	(140K / 1 week) * 8 weeks	**1120K USD**
Simplified RA Impact - SRAI	***RAImpactSimple = RvLossProj*$_{A\text{-}E}$ *- RvLossActual*$_{A\text{-}D}$ *+ RvRecover*	1120K – 140K + 0K	**980K USD**
Full RA Impact - FRAI	***RAImpactFull = RAImpactSimple - ProjIndirectImpact*$_{A\text{-}E}$ *- IndirectImpact*$_{A\text{-}D}$	980K + 80K – 40K	**1020K USD**
Reduced RA Impact - RRAI	***RAImpactReduced*** *= **RAImpactFull - CostRecovery – CostSoln***	1020K – 0K – 30K	**990K USD**

Table 6 - Opportunity Loss for Active RA with formulae

2.8. Reactive RA Impact of Overcharging

Overcharging has a slightly different impact measurement model in that customers have been overcharged. Therefore, there is no direct loss as would be the case for revenue and cost leakage and also for opportunity loss. There are, however, many indirect costs associated with overcharging customers such as customer unhappiness resulting in complaints, customer care overheads, costs for goodwill gestures, reputation loss, regulatory and legal issues and even churn.

The same basic formulae for Revenue Leakage can be used for incidents of overcharging but there is no direct leakage to be included. The impact is mainly due to savings in indirect impacts through early detection of the incident and a reduction in the full potential extent of the issue.

These issues are outlined below.

Variable Measurements

A) Leakage Size (value) before temporary solution ($RvLoss_{A-C}$)

In the case of overbilling (over-rating, incorrect invoice charges, invalid penalties), the RA control that detects the issue should be able to provide some information on the extent of the problem. For overbilling, it is assumed that the overbilled amount will be reimbursed (if significant). The amount of overbilling can be measured and reported but it should not be factored into the leakage size calculation used by the RA impact measurement formulae.

B) Length of time for leakage before temporary solution ($TLoss_{A-C}$)

As per Revenue Leakage scenario.

C) Leakage Size (value) during temporary solution ($RvLoss_{C-D}$)

As per (A) above, the amount of overcharging should not be included in the impact measurement.

D) Projected Leakage Detection Time (with no RA control) ($TLoss_{A-E}$)

As per Revenue Leakage scenario.

E) Recovered Amount (RvRecover)

Overcharged subscribers may be reimbursed when detected, but for the purpose of the impact measurement this value should be zero.

F) Recovery Cost (CostRecovery)

Not applicable (set to zero).

G) Cost of Temporary and Permanent Solution (CostSoln)

The temporary costs might include the cost of reimbursing customers or manually fixing bills and usage charges. The costs for a permanent solution should include the IT and operational costs of fixing the underlying charging or rating problem.

H) Indirect Impact before temporary solution ($IndirectImpact_{A-C}$)

A number of extra costs need to be considered for inclusion in the indirect impact measurement for overcharging. These extra indirect impacts include:

Regulatory fines and Legal costs:

These can occur where there is an inability to provide an expected service or service level. Any fines imposed by regulators or extra legal costs resulting from the opportunity loss should be accounted for as part of the indirect impact.

Cost of goodwill gestures (discounts, credits) to affected subscribers

Where subscribers have been inconvenienced due to an opportunity loss issue and special concessions needed to be made to affected subscribers, these costs should be included as an indirect impact. As well as the actual cost of the goodwill gestures given to subscribers, the internal effort required to donate these should be included.

Cost of increased complaints of customer care

Where an issue results in customers needing to call customer care to find a resolution, there is an indirect impact in terms of the effort in the call center to take the call, and maybe also in terms of the reactive operational effort to correct the symptoms of the issue (but not necessarily the root cause of the issue).

Churn

When an issue results in churn, an indirect impact should be calculated for this (perhaps based on ARPU as above). Churn should not be included in the indirect impact if it has already been accounted for in the leakage size calculations.

Reputation Loss

This is hard to quantify financially. However, for very severe and publically known issues that affect market share or take up of new subscriptions, it can be estimated. Marketing departments may have measurement models that can quantify brand value and financially qualify the drop after a major incident.

Customer Satisfaction Loss

As with reputation loss, this can be hard to quantify accurately and financially. If customers affected by a specific issue are contacted (e.g. to apologize for an issue and make a goodwill gesture), it may be possible to gauge their level of satisfaction and determine that it is lower than it should be (e.g. based on some average for that customer type).

I) Indirect Impacts during temporary solution ($IndirectImpact_{C\text{-}D}$)

As per Revenue Leakage scenario considering the applicable indirect impacts mentioned above.

Reactive Overcharging Impact Formula

The formulae to be used here are the same as for Revenue Leakage although there may be some specific overcharging differences in how the variables used in the formulae are measured as described above.

2.9. Example Calculation for Active RA for Overcharging

The following provides an example of how the above formulae can be used to measure the impact of RA for a specific overcharging scenario. This incident involves a subset of customers having a handset repayment incorrectly put on their bill after their handset subsidies had been repaid. In this example, an RA billing validation control detects the issue before any invoices are printed and issued to customers. The Operator has the opportunity to manually correct the invoices in that bill-run and update the billing system so that the issue does not reoccur in the next billing cycle.

- Overcharging started in October (A). Operator has a bill cycle per week.
- Overcharging was detected before the customer invoices are issued (B is 1 week after A)
- The temporary solution to manually correct the bills was performed. This was done immediately upon detection (C is the same time as B)
- A permanent solution was put in place within 1 week (D is 1 weeks after C).
- This issue could have gone undetected and undiagnosed for up to 8 weeks (E is 8 weeks after A)
- Leakage recovery was not applicable (since no direct leakage)
- The detected overcharging was 20,000 USD per bill cycle.

The indirect impacts were calculated based on the costs the previous time that this problem occurred prior to the billing RA control being in place. The indirect costs were calculated as follows:

- Regulator fine: 10K
- Churn 24K (50 subscribers churned as a direct result. 50 subscribers * 40 USD per month ARPU * 12 months):
- Customer care calls and goodwill gestures to placate affected customers: 30K
- Extra advertising and/or PR spend due to negative press: 20K
- Total Indirect costs per overcharged bill cycle: 84K USD

The measurements are provided by the RA control and subsequent RA investigations into the severity of the problem are shown in the below table.

Variable	Value	Comments
Leakage Size (value) before temporary solution (**$RvLoss_{A-C}$**):	0K USD	20K overcharging per bill cycle for 1 bill cycle but no leakage
Length of time for leakage before temporary solution (**$TLoss_{A-C}$**):	1 weeks	Run RA control daily to detect affected subscribers and manually fix them.
Leakage Size (value) during temporary solution (**$RvLoss_{C-D}$**):	0K	
Projected Leakage Detection Time (with no RA control) (**$TLoss_{A-E}$**)	8 weeks	
Recovered Amount (**RvRecover**)	0K USD	
Cost of Temporary and Permanent Solution (**CostSoln**)	12K USD	7K to manually fix overcharged invoices prior to release and 5K cost to repair the root cause of overcharging in billing
Indirect Impact (**IndirectImpact**)	84K USD	Indirect impact per bill cycle broken down as explained above (will be projected over 8 bill cycles)
Recovery Cost (**CostRecovery**)	0K USD	

Table 7 – Overcharging for Active RA

Note: the time values used are derived from the tables of section 2.2 B & D.

The measurement values in the above tables are then applied to the RA impact formulae as shown in the below table.

Impact Value	Generic Formula	Calculation	Result
Actual Leakage Value with RA control in place	$RvLossActual_{A-D} = RvLoss_{A-C} + RvLoss_{C-D}$	0K + 0K	**0K USD**
Projected leakage with no RA control in place	$RvLossProj_{A-E} = (RvLoss_{A-C} / TLoss_{A-C}) * TLoss_{A-E}$	(0K / 1 week) * 8 weeks	**0K USD**
Simplified RA Impact - SRAI	$RAImpactSimple = RvLossProj_{A-E} - RvLossActual_{A-D} + RvRecover$	0K – 0K + 0K	**0K USD**
Full RA Impact - FRAI	$RAImpactFull = RAImpactSimple - ProjIndirectImpact_{A-E} - IndirectImpact_{A-D}$	0K + 672K – 84K	**588K USD**
Reduced RA Impact - RRAI	$RAImpactReduced = RAImpactFull - CostRecovery – CostSoln$	588K – 0K – 12K	**576K USD**

Table 8 - Overcharging for Active RA with formulae

3. Measuring the impact of proactive/preventive RA

The previous section provided a list of measurements that could be taken and used in a series of formulae to assess the financial impact of active and reactive RA. In those situations, an actual issue was detected by an RA control which affected revenue, costs or opportunity. The impact of reactive and active RA is based on savings due to limiting the extent of incidents through early detection of problems and efforts to recover lost revenue.

Many CSP organizations also focus on proactive RA which attempts to prevent RA incidents from occurring as opposed to reactively dealing with the consequences when they actually happen. Proactive RA can take a number of forms such as performing RA testing and implementing RA controls prior to product launch, performing RA consultancy during product planning to ensure proper compliance and risk reduction strategies, reviewing third party agreements, checking profit margin levels on new services and offers, etc.

With reactive/active RA, there is generally a quantifiable leakage that can be used as a basis to project leakages for RA impact assessment. With Proactive RA, this is usually not the case and it is more difficult to accurately measure its impact.

The model for Proactive RA impact measurement proposed here is explained in the following sections.

3.1. Different treatment to different families of leakages

The intention for Proactive RA impact measurement is to use the same variables and formulae used for reactive/active RA impact measurement but use a different technique to decide what values to use in the variables. The pre-existing formulae provide a model to calculate simple, full and reduced RA impact based on measures like size of leakage, recovered value, indirect impact and a series of projections forward in time based on when it is thought the issue would have been discovered by means other than the detecting proactive RA activity.

The formulae used for active and reactive RA impact measurement were used for all four types of RA incident: revenue leakage; cost leakage; opportunity loss; and overcharging. For each family, there were some differences in which variables were used in the formulae and how these variables were measured.

The intention for proactive RA measurement is to reuse the same model and formulae for impact assessment and describe what needs to be measured for each variable. All four families of leakage are dealt with in the same way for proactive RA impact measurement. Some guidelines for measuring the relevant variables are described below. The person assessing the impact of a specific risk or issue identified via proactive efforts will need to categorize it into one of the four families of issues and perform the measurements accordingly.

The main difference between proactive impact measurement and reactive is that for proactive RA, the incident has not yet happened and caused any real leakage, loss or

overcharging. This provides a challenge as a figure for the extent of the leakage or loss is required for the formulae to work. The leakage and loss value must be estimated for each risk or incident identified in proactive RA activities. In some cases where RA are involved in pre-launch testing for a new or updated service, representative leakage or loss figures may be available. These figures from limited volume testing may need to be projected upwards based on the extent of the incident during the testing to the expected production level usage of that service once it goes live.

3.2. Proactive RA Impact of Revenue Leakage, Cost Leakage, Opportunity Loss and Overcharging

In the case of Proactive RA, the incident may have actually occurred (e.g. in pre-release testing) and its leakage size is easily quantifiable. If not, an educated estimation should be made to determine the potential size of the leakage, loss or overcharging which would result if the service went live without the proactive control detecting a risk or incident.

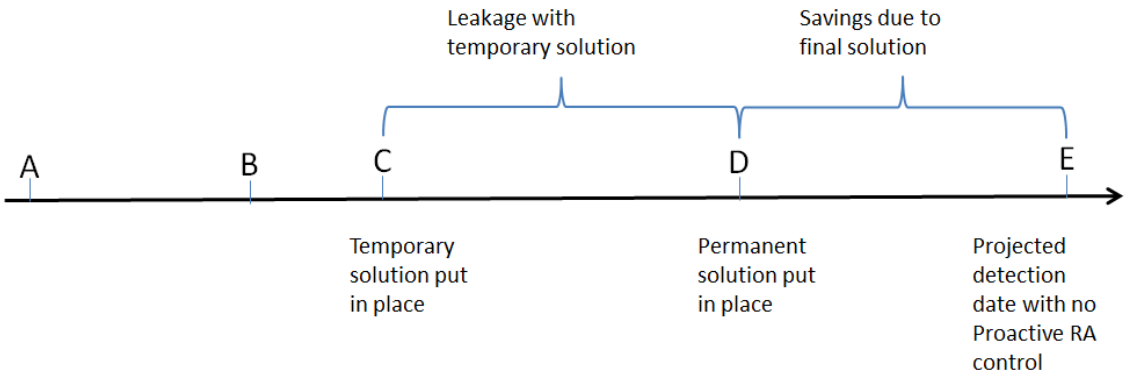

Figure 3 – Cost Leakage for Proactive RA

1) Proactive RA activities begin before product/service launch or planned activity can generate a real incident.
2) A potential incident is detected by proactive RA control or activity (B)
3) If the issue is still relevant at launch, a temporary fix may be put in place to prevent or limit the impact of the incident, if applicable (C). This is considered the point at which the system goes live (launch).

4) Revenue Recovery efforts are made to recover leakages or losses between C and D, if applicable
5) Final solution is put in place to stop the incident (D)
6) Projected date to when the incident may have been detected by other means than the RA control (E)

Based on the above sequence, a serious leakage, loss or overcharging should be avoided through detection of a potential incident and some preventative action to stop or limit any real incidents post-launch. It is possible that a proper preventative solution cannot be implemented prior for the launch, but it may be possible to put a temporary solution into place which will limit the scale of the incident.

When these issues are detected, some measurements or educated estimates need to be taken for the purposes of impact assessment. This process should be similar to the process for active/reactive RA.

The basic impact measurement approach is to project the leakages/losses/overcharging and its indirect impacts over the expected incident lifetime (A to E) as if the incident had not been detected by proactive RA activities. The simple impact will be a combination of the projected leakages and the projected indirect impacts from A to E less the actual leakages and impacts suffered between C and D. The leakages and indirect impacts between A and C are not used in the final simple impact calculations as they never occurred. They may be measured or estimated though and used as the basis for the estimation of the projected leakages and indirect impacts between A and E.

Variable Measurements

A) Estimated Leakage Size (value) before temporary solution ($RvLoss_{A-C}$)

In this case, an estimated leakage size needs to be chosen as if this problem actually happened after launch. This may be straightforward in cases where an RA control detected an actual issue in pre-launch testing which will allow easy estimation and projection of what the impact would be had this issue occurred in production.

In other cases, such as where specific preventative measures have been put in place in the absence of a known problem, there is less raw data to base a predicted leakage size on. In these cases, good judgment and experience based on similar issues in the past or a model of what might have happened if this issue occurred will need to be utilized.

The value for the leakage size should be estimated for a single time period (e.g. 1 day, week, or month).

B) Length of time for leakage before temporary solution ($TLoss_{A-C}$)

This should be set to 1 for proactive impact assessment as no actual leakage occurred.

C) Leakage Size (value) during temporary solution ($RvLoss_{C-D}$)

If there was leakage after launch before a final solution was put in place, it should be measured and recorded in this variable.

D) Projected Leakage Detection Time (with no RA control) ($TLoss_{A-E}$)

This is a projected date when the issue might have been detected after launch. It should be estimated in the same way as for active/reactive RA impact assessment. The measurement should be expressed in a number of days, weeks or months.

E) Recovered Amount (RvRecover)

This variable should be set to zero unless there was recovered leakage during C and D when the temporary solution was in place.

F) Recovery Cost (CostRecovery)

This measure covers the costs of recovering the leaked revenue if applicable. These costs could be in time and effort but need to be translated into monetary values for this measure.

G) Cost of Temporary and Permanent Solution (CostSoln)

This measure covers the cost of performing the root cause investigation and the costs for implementing a temporary (if applicable) and permanent solution to rectify the root causes of the leakage.

H) Indirect Impact before temporary solution ($IndirectImpact_{A-C}$)

The previous sections on active/reactive impact assessment provide a list of potential impacts to be considered for revenue leakage, cost leakage, opportunity loss and overcharging. The same indirect impacts should be considered depending on the nature of the issue or risk identified by proactive efforts.

For proactive impact measurements, the indirect impacts can be estimated in a similar way to the leakage or loss size (i.e. based on previous experience of similar problems or on a best-effort basis). There would not have been any real indirect impact between A and C as this was the period prior to launch, but for the purposes of estimation and projection it can be useful to estimate this value.

I) Indirect Impact during temporary solution ($IndirectImpact_{C-D}$)

After detection of a revenue leakage, a temporary solution may be put in place to stop or reduce the leakage. This measurement measures the indirect impact during the period between the temporary solution being implemented and a permanent fix being put in place. The value of this measurement will be zero if either no temporary

solution was put in place or the temporary solution prevented all further indirect impacts for this problem.

J) Actual Indirect Impact (**IndirectImpact$_{A-D}$**)

This impact is usually calculated based on adding the indirect impacts from A to C and from C to D. In the case of proactive RA, the indirect impact from A to C (**IndirectImpact$_{A-C}$**) is estimated based on what the indirect impact would have been had this incident not been detected and at least partially corrected before going live.

This is used in subsequent calculations to project the indirect impact forward. The actual indirect impact is the real indirect impact between launch (at C) and the permanent fix being applied (at D). The value for **IndirectImpact$_{A-D}$** should be the real indirect impact realized between C and D, i.e. **IndirectImpact$_{A-D}$** and **IndirectImpact$_{C-D}$** should be the same value for the calculation below.

Once the above measurements have been performed for a pre-launch detected issue or preventative measure, the values can be used in the previous supplied formulae to calculate the simple, full and reduced RA impact.

The resulting values should then be factored down based on the perceived likelihood of that issue actually happening in production. If the issue was found during pre-launch testing and is sure to happen after launch, the likelihood should be set to 100%. If it was a theoretical concern or a preventative improvement which was performed as a result of a proactive RA activity, then the likelihood can be set lower (e.g. to 50%). The likelihood should then be multiplied by the RA impact to come up with risk-adjusted simple, full and reduced RA impact measurements.

3.3. Example Calculation for Proactive RA

The example below outlines an example of how a proactive RA activity might prevent an incident and how the model presented in this document can be used to measure the full impact of that prevention. The example shown here is for proactive RA effort to prevent an opportunity loss but a similar approach is taken for revenue leakage, cost leakage, and overcharging. Please refer to the proactive example below and the reactive examples for each incident type in the previous sections for advice on what measurements should be made and what considerations should be included.

During pre-launch testing by RA using a provisioning integrity control, an issue was detected. There was a problem with incorrect APNs for a specific tariff class of newly provisioned subscribers. This would have resulted in an opportunity loss as the affected subscribers would have been unable to use the proper high speed data connection that they should have been provisioned to use. After discovery, a temporary fix was put in place which corrected the symptoms of the problem for the affected subscribers (but did not fix the root cause). After a period of time in production, a final solution was implemented that completely resolved the problem.

Had the scheduled release gone ahead with the original problem undetected, customers would have been subjected to a poor quality of service for their data connection. A significant effort would have been needed to contact these customers, fix the misconfiguration and goodwill payments may have been necessary to compensate them.

Since proactive RA activities detected the issue and a temporary solution was put in place before launch, no real customers were affected and there was no real opportunity loss. However, this issue would have had a significant opportunity loss with a number of indirect impacts if the launch had proceeded with this problem undetected. The calculation below shows how the impact for these proactive measures could be estimated.

- Estimate that the incident would have persisted for 8 weeks before it was caught and fixed without Proactive RA activities detecting the issue pre-launch. **$TLoss_{A-E}$** = 8 weeks
- Based on the pre-launch testing, it was estimated that all new subscribers on a specific tariff plan would be affected. Because of the reduced data bandwidth available to subscribers, it was estimated that they would spend 5 USD per week less on data services than if they could have used the correct faster connection. Estimate that the opportunity loss would be 2000 subscribers * 5 USD = 10K USD per week. **$RvLoss_{A-C}$** = 10K
- There would be no opportunity loss between C and D in this example as the temporary solution rectifies the problem for affected subscribers **$RvLoss_{C-D}$** = 0.
- Revenue recovery and recovery cost is not applicable (since there was no direct leakage)
- Cost of temporary solution was 5K
- Cost of permanent solution was 20K
- Indirect impact is estimated at 5K per week for the duration of the incident. This covers the customer care, reactive provisioning fixed on a per subscriber basis and any goodwill gestures given to affected subscribers that complained.

The measurements are provided by the proactive RA activity and subsequent RA investigation into the severity of the problem are shown in the below table.

Variable	Value	Comments
Leakage Size (value) before temporary solution (**$RvLoss_{A-C}$**):	10K USD	10K per week in opportunity loss would have occurred during launch. This value is used for projection of the

		estimated loss from A to E. However, a value of zero is used for the simple RA impact calculation as there was no real leakage between A and C.
Length of time for leakage before temporary solution (**$TLoss_{A-C}$**):	1 week	Set to 1 for calculation
Leakage Size (value) during temporary solution (**$RvLoss_{C-D}$**):	0K	Temporary solution stops opportunity loss
Projected Leakage Detection Time (with no RA control) (**$TLoss_{A-E}$**)	8 weeks	
Recovered Amount (**RvRecover**)	0K USD	N/A
Cost of Temporary and Permanent Solution (**CostSoln**)	25K USD	5K for temporary solution and 20K for permanent solution
Indirect Impact (**IndirectImpact**)	5K USD per week	It is estimated that the indirect impact would have been 5K per week (will be projected over 8 weeks from A to E). The real indirect impact from A to D is zero though as no real impact occurred due to proactive incident prevention.
Recovery Cost (**CostRecovery**)	0K USD	N/A

Table 9 – Proactive RA

Note: the time values used are derived from the tables of section 2.2 B & D.

The measurement values in the above tables are then applied to the RA impact formulae as shown in the below table.

Impact Value	Generic Formula	Calculation	Result
Actual Leakage Value with RA control in place	$RvLossActual_{A-D} = RvLoss_{A-C} + RvLoss_{C-D}$	0K + 0K	**0K USD**
Projected leakage with no RA control in place	$RvLossProj_{A-E} = (RvLoss_{A-C} / TLoss_{A-C}) * TLoss_{A-E}$	(10K / 1 week) * 8 weeks	**80K USD**
Simplified RA Impact - SRAI	$RAImpactSimple = RvLossProj_{A-E} - RvLossActual_{A-D} + RvRecover$	80K – 0K + 0K	**80K USD**
Full RA Impact - FRAI	$RAImpactFull = RAImpactSimple + ProjIndirectImpact_{A-E} - IndirectImpact_{A-D}$	80K + 40K – 0K	**120K USD**
Reduced RA Impact - RRAI	$RAImpactReduced = RAImpactFull - CostRecovery – CostSoln$	120K – 0K – 25K	**95K USD**

Table 10 – Proactive RA with formulae

4. Measuring the impact of RA in terms of Risk Mitigation

4.1. Introduction

Adding the Risk dimension to Revenue Management RA provides important aspects to the overall analysis and decision support. There is an emerging need throughout the overall Telecom Industry to:

- Assess risk scoring and financial impacts at all relevant business levels
- Prioritize risks
- Determine Leakage Mitigation by each measure
- Assess required coverage, for current business/technical service environment as well as for future services (both reactive and proactive)
- Assess the Mitigated financial contribution, at all relevant business levels

The following sections address the needs mentioned above.

At the heart of the solution resides a pre-defined Risk Model. The model complies with the GB941-E, Revenue Assurance Risk Coverage Model. The following section gives an overview of the model in GB941-E, and shows how to extend it to measure the impact of RA. It is recommended that users are familiar with GB941-E before reading the following section.

4.2. Revenue Assurance Risk Coverage Model

Model structure

The Risk model is a hierarchical formalization representing all possible RA Risks affecting all possible Lines of Business and Business Processes. The idea is that each Business Process (e.g. Orders, Provisioning, Billing, etc.) is affected by a set of Risks (mostly revenue leakages, but also operational and regulatory). These Risks are pre-defined. For each Risk, the model maps the relevant RA Controls and Measures that are aimed to either detect & quantify the revenue impact of risks (reactive measures) or prevent future occurrence of revenue affecting risks (proactive measures).

The overall Risk Model is mapped to each of the (relevant) Lines of Business, providing the RA Expert (or Risk Expert) both a “bird’s-eye view” and a detailed view of all revenue threats, as well as all the possible controls, procedures and measures to address them. In that sense, the Revenue Assurance Risk Coverage Model becomes a major methodology driven guideline, using unified terminology and measurement methods. The Revenue Assurance Risk Model spans all LoB Business Processes, providing management, finance, decision makers and technical disciplines with a clear overview of existing threats and the effectiveness of solutions.

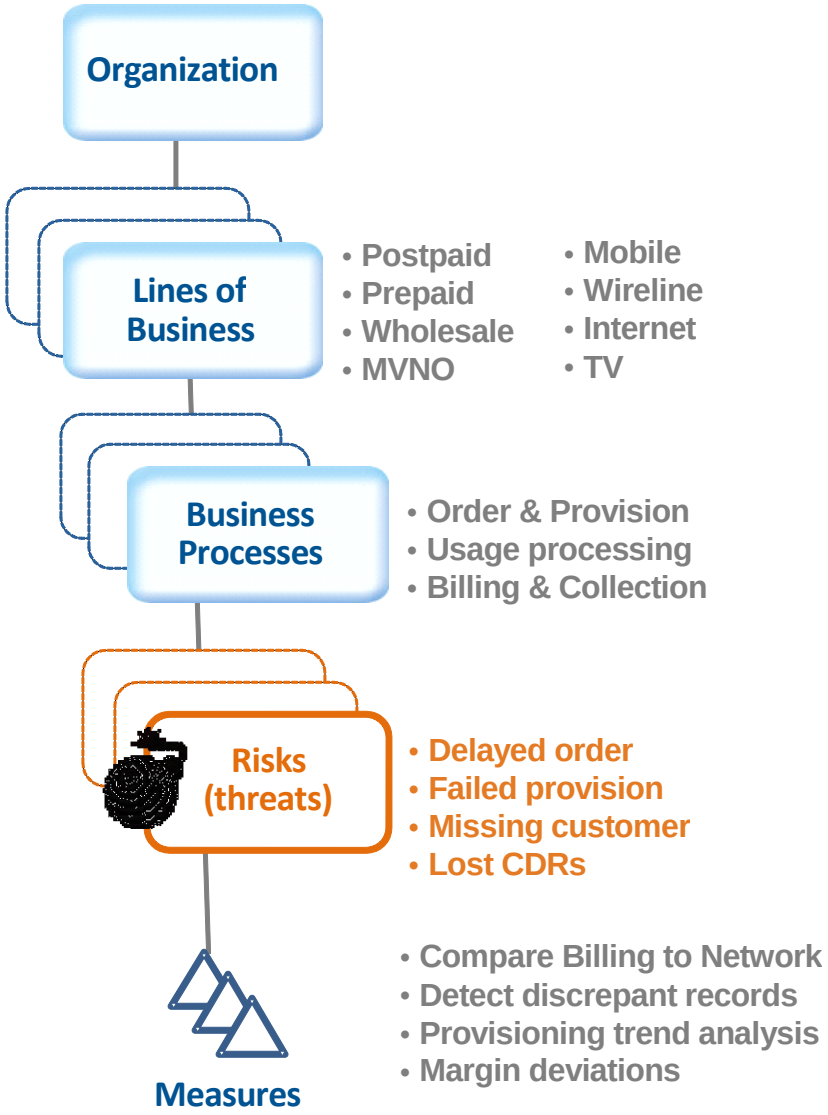

Figure 4 - Risk Model

The **Organization** (usually a Telecoms or Service Provisioning organization) may have a variety of Lines of Business.

A **Line of Business** (LoB) is usually the "accountable" business area, recognized as such by the Organization. An LoB is treated as such by the organization's accounting as an autonomous profit and loss entity. An LoB usually harbors a service or several services aimed at a specific group of customers or peers and usually cover the overall life cycle of the service/services.

Examples of viable LoBs:

- Retail
- Wholesale
- Interconnect
- Prepaid
- MVNO
- TV / Digital TV
- VoD
- VAS
- etc.

A single LoB may include a variety of technologies and bearers (such Mobile, Fix, IN and Voice, Messaging, Data, Streaming, etc.).

It is uncommon to use a bearer (e.g. voice, data, messaging) or a technology (e.g., LTE) as an LoB. However, if the bearer or technology is the accountable business entity, then it can be used as an LoB.

Each LoB is an envelope (container) for the service/s life cycle's **Business Processes**[1] (BPs). These BPs cover all revenue affecting aspects of each service's life cycle. Therefore, the BPs are applicable to all LoBs (although with different impact according to the service type).

The following table lists the relevant Business Processes:

Business Processes
Order Entry and Provisioning
Network and usage Management
Rating and Billing
Finance & Accounting
Customers management

[1] Note the business process here do not correspond to the business processes as defined in the business processes framework (eTOM), for a mapping see GB941-D

Partners management
Products and Offers management

Table 11 – List of Business Processes

Each BP is associated with one or more revenue affecting Risks (threats) as shown in the example below:

Business Process	Business Sub-Process	Risk	Description	Leakage Category
Order Entry and Provisioning	Configuration	incorrect Reference data	Routing (including Least cost, Best quality & best value routings), numbering schemes/portability, etc. are not configured accurately in the network and/or processing platforms, interconnect, VAS, trunks, trunk groups	Revenue Leakage / Over Charge Cost Leakage
Order Entry and Provisioning	Order Entry	Delay in Order processing	Delay only	Opportunity Loss
Order Entry and Provisioning	Order Entry	Failure in order processing	Error or loss	Opportunity Loss
Order Entry and Provisioning	Order Entry	Erroneous order inputs	Insufficient or Erroneous data entered by CSR or automated system	Revenue Leakage / Over Charge
Order Entry and Provisioning	Provisioning	Failure in provisioning resulting in lack of charging	usage without payment	Opportunity Loss

Order Entry and Provisioning	Provisioning	Failure in provisioning resulting in lack of service	No usage or illegitimate charges	Revenue Leakage
Order Entry and Provisioning	Provisioning	Failure in equipment provisioning	Missing or unpaid provisioning, errors in ERP "warehouses", etc.	Revenue Leakage
Order Entry and Provisioning	Provisioning	Provisioning delay	Delay only	Opportunity Loss
Order Entry and Provisioning	Provisioning	Stranded Assets	Cannot use resources. In certain cases can also affect CAPEX (cost).	Opportunity Loss

Table 12 – BPs and associated risks

The Risk level is the focal point of the Revenue Assurance Coverage Risk Model. It holds the necessary risk scoring and financial impact that are reflected upward towards the LoB and Organization levels. It points to the relevant Measures used for its revenue impact mitigations. Finally, it provides the reflection of that mitigation (score and finance vise) towards the upper business levels.

The following tables list an example of how Measures are linked to Risks.

The first table lists the relevant measures associated with each Risk (in the example below each measurement associated with the “Orders and Provisioning” Business Process is identified as OPxx (where xx is an index number).

					Measures					
Business Process	Business Sub-Process	Risk Description	Leakage Category	Leakage Description	M1	M2	M3	M4	M5	M6
Order Entry and Provisioning	Configuration	Incorrect Reference data	Revenue Leakage	Leakage due to Incorrect reference data: Routing (including Least cost,	OP19	OP20	OP21	OP17	OP18	
Order Entry and Provisioning	Order Entry	Delay in Order processing	Opportunity Loss	Delay in OE processing: from the time the customer sign to the time he is	OP01	OP02	OP03	OP04	OP05	OP12
Order Entry and Provisioning	Order Entry	Failure in order processing	Opportunity Loss	Error or loss due to Failure in order processing	OP01	OP02	OP03	OP04	OP05	OP12
Order Entry and Provisioning	Order Entry	Wrong order inputs	Opportunity Loss	Insufficient or Erroneous data entered by CSR or automated system.	OP06	OP07				
Order Entry and Provisioning	Provisioning	Failure in provisioning resulting in lack of charging	Revenue Leakage	Usage without payment: Customer/Related Service exists on network but not	OP08	OP12	OP13	OP14	OP15	
Order Entry and Provisioning	Provisioning	Failure in provisioning resulting in lack of service	Revenue Leakage	No usage or illegitimate charges: Customers and related services live in billing, but not	OP09	OP12	OP13	OP14	OP15	

Table 13 – Measures associated with each risk

The table below provides a description for each Measure and defines the expected Impact and Likelihood mitigation values. The example below addresses some OPxx measures.

Measure Ref.	Process Area	Sub Process Area	Control Type	GB941_D reference	Measure	Short description	Impact Mitigation	Likelihood Mitigation
OP01	Order Entry and Provisioning	Order Entry	Completeness	B.1 (2.2.1)	Verify that Customers' orders/cancellations/updates are registered in the CRM	Verify that the customer order/registration is registered correctly in CRM. For all order's channels: Customer Care, Web Portals, SMS, Shops, Dealers, etc. (e.g. by: action type, counts, pseudo revenues, percentages, product)	4	2
OP02	Order Entry and Provisioning	Order Entry	Trend	B.8 (2.2.8)	Look for deviation of Customers' orders/cancel	Look for "suspicious deviations" against values of a previous period (e.g. by: action type, counts, pseudo	2	1
OP03	Order Entry and Provisioning	Order Entry	Correctness	B.3 (2.2.3)	Verify new customers'	Verify identity and payment method	4	2
OP04	Order Entry and Provisioning	Order Entry	Correctness	B.2 (2.2.2)	Valid data entered to the order systems	Verify that the data entered is valid, and that appropriate validation processes are taking place as part of the operational process (e.g. address validation)	4	2

Table 14 – Measure descriptions and expected values

Each measure has maximal mitigation levels on the risk likelihood and impact. For example, by what maximal amount the risk likelihood and impact will be reduced if the measure is implemented.

Model parameters

The following paragraphs address the Risk Modeling parameters associated with each of the model's levels. These parameters span the risk scoring and the revenue financial impact domains.

The table below provides descriptions for the terms used in the following paragraphs.

Term	Description
Inherent Risk	The level of Risk without any mitigation
Risk Impact	The rate of a risk-induced financial impact
Risk Likelihood	The probability of a risk occurrence
Mitigated Risk	The contribution of mitigation by measures
Residual Risk	The level of risk after mitigation is applied
Financial Impact	The amount of financial risk without any mitigation
Detected leakage	The amount of money detected/recovered by measures
Mitigated Impact	The level of impact mitigation by a measure
Mitigated Likelihood	The level of likelihood mitigation by a measure
Extent	The level of data coverage by a measure
Frequency	The frequency rate of a measure's activity
Effectiveness	Derived, for a measure, from the Extent and Frequency above

Table 15 – Model terms and descriptions

Risk Level

The following parameters are associated with each Risk:

- Inherent Risk (see GB941 E)
  as defined by the following attributes:
  - Risk Impact
  - Risk Likelihood

- Financial Impact
- Mitigated Risk (see GB941 E)
- Residual Risk (see GB941 E)
- Detected Leakage

Line of Business (LoB) Level

- Inherent Risk score
- Financial Impact
- Residual Risk score
- Detected Leakage

Organization Level

- Inherent Risk score
- Financial Impact
- Residual Risk score
    - Detected Leakage

Measure Level

- Mitigated Risk (see GB941 E) as defined by the following attributes:
    - Mitigated Impact
    - Mitigated Likelihood
    - Effectiveness
      as defined by:
        - Extent
        - Frequency
- Detected Leakage

Note: all the above parameters, excluding those defined by GB941, are addressed in the following sections.

4.3. Inherent Risk

Risk Level

Risk parameters

As defined by GB941 E:

Inherent Risk = Risk Impact * Risk Likelihood/5

Where both Impact and Likelihood are defined by the user; each has a value of 1-5. The definition of each of the values is found in GB941-E.

Financial parameters

The Mean Financial impact of a Risk is the percentage of revenue to be lost (according to the table below) multiplied by the total gross revenue of the associated Line of Business or the total gross revenue of the Organization.

Risks impact

Risks Likelihood

	1	2	3	4	5
1	0.005	0.05	0.1	0.3	0.5
2	0.015	0.15	0.3	0.9	1.5
3	0.025	0.25	0.5	1.5	2.5
4	0.035	0.35	0.7	2.1	3.5
5	0.045	0.45	0.9	2.7	4.5

Figure 5 - Mean Financial impact of Risk

Each of the above values represents a mean percentage value that addresses the ratio of the expected financial loss or leakage out of the total gross revenues of either the overall organization or the relevant LoB. This depends on the approach adopted for rating risks. The organization's revenues may be used as a reference, or the LoB revenues may be considered as a reference.

Example:

If a particular risk associated with Pre-paid has an impact of 3 and a likelihood of 2, where the overall monthly revenues for Pre-paid is 15,000,000 USD.

Then:

The intersection of the likelihood and Impact values is 0.3%

Monthly Risk Financial Value = 15,000,000 * 0.25% = 45,000 USD

Example 2:

Total Gross Revenue
10000

	Impact	Likelihood
Risk 1	5	5
Risk 2	3	3
Risk 3	1	1

	Impact	Likelihood	mean of revenue at Risk %
Risk 1	5	5	4.5
Risk 2	3	3	0.5
Risk 3	1	1	0.005

	Impact	Likelihood	mean of revenue at Risk %	Mean Financial impact
Risk 1	5	5	4.5	450
Risk 2	3	3	0.5	50
Risk 3	1	1	0.005	5

Mean Financial Score for **Risk 1**= **450**

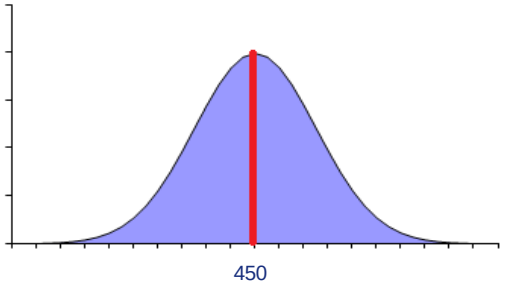

Figure 6 – Mean Financial Score

LoB Level

Financial Value Restraining coefficient

Given absolute mutual exclusiveness (no correlation) between the different risks, the mean financial impact at the LoB level is sum of the mean financial impact of the relevant risks. Practice shows that even though the risks are “almost” not correlated, there is always a small degree of correlation. Calculating or estimating the exact degree of correlation is impractical. Therefore, we propose an approach based on the assumption that a higher number of existing risks reduce the mutual exclusiveness. Hence, the number of active risks associated to an LoB bears significance.

Therefore, we need to have a restraining coefficient when summing up the overall financial impacts of all associated risks to their LoB level.

The following table provides a guideline for the values for the Financial Impact Restraining coefficient, K.

Number of LoB Risks	*K* *Financial value Restraining coefficient*
1	*1.00*
2-6	*0.80*
7-8	*0.60*
9-10	*0.55*
11-20	*0.52*
>20	*0.5*

Table 16 - Financial Impact Restraining coefficient, K

Note: These values should be considered as a guideline to be used in the absence of additional information. Also, the above table assumes that the Mutual Exclusive value is, at least, in the vicinity of 95%

Financial parameters

The **Mean Financial impact** at the LoB level is calculated by:

$$\sum \textit{Mean Financial Impact}_{\textit{(for all LoB Risks)}} * \textit{Financial Impact Restraining coefficient}$$

For example:

Assume that the overall monthly revenues for Pre-paid are 15,000,000 USD and the Mean Financial Impacts of five particular Risks are:

Risk1: 100,000 USD

Risk2: 450,000 USD

Risk3: 2,365 USD

Risk4: 24,500 USD

Risk5: 240,000 USD

Then:

Sum of all Mean Financial Impacts: 816,865 USD

Coefficient of 5 Risks = 0.8

The LoB Mean Financial Impact = 816,865*0.8 = *653,492 USD*

Organization Level

The **Mean Financial impact** at the Organization level is calculated by:

$$\sum \textit{Mean Financial Impact}_{\textit{(for all LoBs)}}$$

4.4. Mitigation

The role of Measures is to Mitigate the level of Inherent Risk.

Measure Level

Mitigated Risk parameters

As defined by GB941 E:

Measure Impact Mitigation = Mitigated_Impact * Effectivness
Measure Likelihood Mitigation = Mitigated_Likelihood * Effectivness

Where both Impact and Likelihood are pre defined by the Measure Type and each has a value of 1-5.

Effectiveness is derived from the user-defined Extent and Frequency parameters.

Risk Level

Mitigated Risk

The Mitigation resulted by all "active" Risk's Measures is defined by:

$$\textit{Mitigated Impact Risk} = \textit{minimum}\left[(\textit{Inherent\_Risk\_Impact} - 1),\ \sum(\textit{Measure Impact Mitigation}_{\textit{(for all Risk's measures)}})\right]$$

$$\textit{Mitigated Likelihood Risk} = \textit{minimum}\left[(\textit{Inherent\_Risk\_likelihood} - 1),\ \sum(\textit{Measure Likelihood Mitigation}_{\textit{(for all Risk's measures)}})\right]$$

Residual Risk

The Residual Risk, where Measures are in place is defined by:

Residual Impact Risk = Inherent Risk Impact – Mitigated Impact Risk

Residual Likelihood Risk = Inherent Risk – Mitigated Likelihood Risk

The **Mean Financial Residual impact** of a Risk is the percentage of revenue to be lost due to the residual Risk (according to the table in section 4.3) multiplied by the total gross revenue of the associated Line of Business or the total gross revenue of the Organization

LoB Level

The **Mean Financial Residual impact** at the LoB level is the sum of all the ***Mean Financial Residual Impacts*** per all the risks associated with the LoB.

Mean Financial Residual *LoB* = ∑ *Mean Financial* Residual *Impact (for all LoB Risks)*

Organization Level

The **Mean Financial Residual impact** at the Organization level is the sum of all the ***Mean Financial Residual Impacts*** per all the risks associated with the LoB.

Mean Financial Residual *Organization* = ∑ *Mean Financial* Residual *Impact (for all* Organization *LoB)*

4.5. Example

An Organization generates 10M USD in revenue per month.

The Organization has two LoBs:

- Pre-paid – 60% of the revenues: 6M USD monthly
- Retail – 40% of the revenues – 4M USD monthly

Both Pre-paid and Retail LoBs are plagued with the following Risks:

Risk	Impact	Likelihood	Inherent Risk	Mean Financial Impact
CDRs are lost by Network Elements	4 (a)	3 (b)	2.4	6M*1.5% = 90,000 (c)
Service registered in network but not in billing	4 (d)	5 (e)	4	4M*2.7% = 108,000 (f)

Table 17 – Prepaid and LoB risks

Note: Inherent Risk = (Impact * Likelihood)/5

The following Measures are implemented:

Risk	Measure	Mitigated Impact	Mitigated Likelihood	Effectiveness	Measure Impact Mitigation	Measure Likelihood Mitigation
CDRs are lost by Network Elements	Compare Switch vs. Probe CDRs	4	2	25%	4*0.25 = 1 (g)	2*0.25 = 0.5 (h)
CDRs are lost by Network Elements	Check Switch file sequence numbers	1	0	90%	1*0.9 = 0.9 (i)	0*0.9 = 0 (j)
Service registered in billing, not on network	Billing vs. Network inventory	2	2	75%	2*0.75 = 1.5 (k)	2*0.75 = 1.5 (l)

Table 18 – Implemented Measures

Calculations at the risk level:

Risk	Mitigated Impact Risk	Residual Impact Risk	Mitigated Likelihood Risk	Residual Likelihood Risk	Mean Financial Residual Impact	RA contribution
CDRs are lost by Network Elements	Min(a,g+i) = Min (4,1+0.9) = 1.9	=a-1.9 =4-1.9 =2.1 ~2	Min(b,h+g) = Min (3,0.5+0) = 0.5	= b-0.5 =3-1.5 =1.5 ~2	6M *0.15% = 9000	= 90,000-9,000 = 81,000
Service registered in network but not in billing	Min (d,k) = Min(4,1.5) = 1.5	=d-1.5 =4-1.5 =2.5 ~3	Min (e,l) = Min(5,1.5) = 1.5	=e-1.5 =5-1.5 =3.5 ~4	4M*0.7% = 28,000	= 108,000-28,000 = 80,000

Table 19 – Risk Level Calculations

5. Administrative Appendix

5.1. About this document

This is addendum F of GB941 – Revenue Assurance Guide book.

5.2. Document History

Version History

Version Number	Date Modified	Modified by:	Description of changes
0.1	1/12/2011	Fergal McGuinness, Moshe Zolotov, Gadi Solotorevsky	first draft of document
0.2	1/4/2012	Fergal McGuinness, Moshe Zolotov, Gadi Solotorevsky	Substantial content added to the document
0.3	02/07/2012	Fergal McGuinness, Moshe Zolotov, Gadi Solotorevsky	Changes following Catalyst project in Dublin 2012 and members review – first version ready for release
0.4	17/10/2012	Alicja Kawecki	Minor formatting/style corrections prior to web posting and Member Evaluation

Release History

Release Number	Date Modified	Modified by:	Description of changes
1	02/07/2012	Fergal McGuinness, Moshe Zolotov, Gadi Solotorevsky	First issue of document

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5.4. Acknowledgments

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