Multi Vendor Network Parameter Management

Whitepaper

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Intelligent Optimization

Glossary

BSC	Base Station Controller
GPEH	Global Parameter Event Handler
MGw	Media Gateway
MSC	Mobile Switching Center
MTR	Mobile Traffic Recording
NMS	Network Management System
NOC	Network Operations Center
OSS	Operations Support System
RBS	Radio Base Station
RNC	Radio Network Controller
UETR	User Equipment Traffic Recording
UI	User Interface

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Introduction

Radio Network quality in a cellular network can be used as a barometer to gauge the overall quality of a network. This is in a large part due to the fact that the mobile network's quality is dominated by a substantial number of environmental factors. By tracking a few key performance indicators (KPIs) in the radio network, call quality and subscribers' perception of the quality of the network can be monitored. These KPI include, for example, blocked calls, dropped calls, voice quality and throughput.

Radio Network Optimization is geared towards the maximization of call quality in a live mobile network at any given point in time, from the perspective of the radio network. By optimizing the radio network on a daily basis, subscribers can enjoy the best call quality at whatever stage the cellular network is in– whether during expansion or maintenance phases.

Part I of this white paper is a general introduction to the Radio Optimization Process in a generic mobile network Operator. It attempts to describe the Quality Management Process for Radio Optimization departments as a series of overlapping processes which, in concert, aim to maintain and improv Quality of Service for the subscribers from a day-to-day perspective right up to the medium and longer term

Part II will address one aspect of the Optimization Process which deals with managing key parameters in the mobile network in a multi-vendor and multi-technology environment. Management of these parameters is the most basic requirement to maintain QoS in a mobile network environment which is ever dynamic in terms of its growth and subscriber mobility and forms the basis for further work to improve network QoS. Part II shows that failure to address these inconsistent parameters can lead to degraded QoS such as
dropped calls.

Radio Network Optimization

1 Radio Network Optimization Processes

Radio Network Optimization departments encapsulate this quality driven network optimization process in their own departmental processes. Figure A below shows the quality driven radio network optimization processes divided into three levels as pictured below:

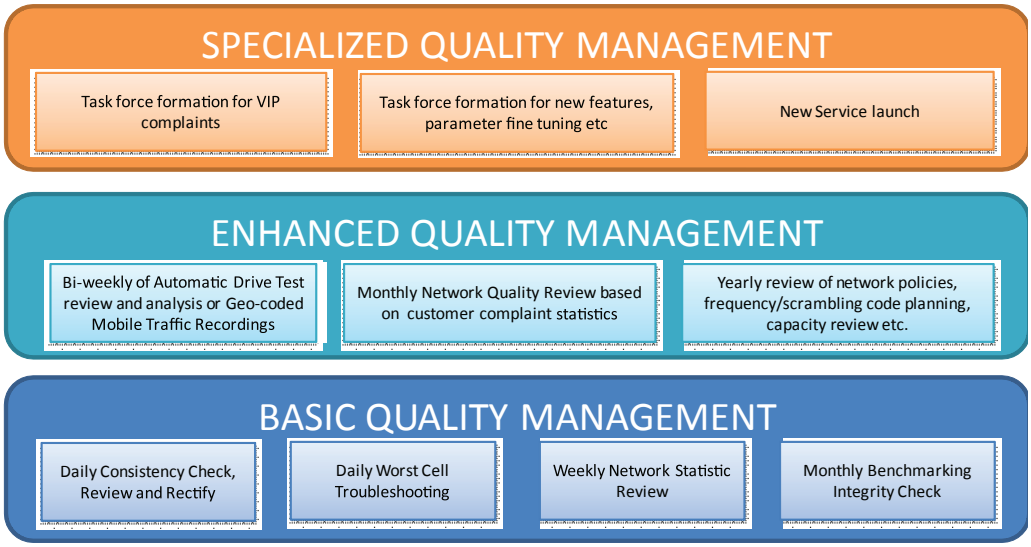

Figure A: Generic quality driven radio network optimisation processes

Quality Management Processes

The Quality Management process can be divided into 3 high level processes, defined here as:

1. Basic Quality Management
2. Enhanced Quality Management
3. Specialized Quality Management

In Basic Quality Management, optimization processes encompass activities that are required to minimally maintain the network quality and provide a basis for consistent network performance. Such consistent network performance is fundamental to preventing churn due to network quality issues.

In Enhanced Quality Management, optimization processes are put in place to provide additional quality improvements instead of pure maintenance. Enhanced Quality Management processes include broad based strategies such as area based frequency / scrambling code planning and network reviews.

In Specialized Quality Management, optimization processes include launching of new features and parameter tuning as well as specialized task forces for areas such in-buildings or key customer routes.

Basic Quality Management

1.2.1 Daily Processes

1.2.1.1 Worst Cell Trouble-Shooting

On a day to day basis, worst performing cells in the network need to be identified and root causes for such low performance investigated. The process of trouble shooting these cells ensures that on a daily basis, high priority cells with QoS issues are always monitored. Whilst this may seem an operational issue, optimization or quality departments, as the primary party responsible for network quality, need to also ensure that there is always a solution available to solve these cause of network quality degradation, be it an operational (such as a hardware fix) or optimization activity (such as a scrambling code or parameter change).

1.2.1.2 Network Parameter Management

Network Parameter Management and the underlying activity of parameter consistency checking is done to ensure that parameters such as neighbor definitions are consistent within the BSS (intra- and inter-BSC or RNC) and between the BSS and core network (BSC/RNC to MSC) even as the network continuously changes from day to day to site expansions, re-homing and optimization work.
Considerable problems do arise from inconsistent parameter settings in the BSS database and core network which can cause handover failures and dropped calls. In single vendor environments, a large part of this can be taken care of with internal consistency checks which are part of the NMS software package and should be run daily. In a multi-vendor environment, as the formats for parameter databases are not standardized, this is done via internal macros, custom made software, an internal procedure or, in some cases, not at all.

1.2.2 Weekly Processes

1.2.2.1 Statistical Performance Monitoring

This process involves the monitoring of statistics from the core network and the BSS on a weekly basis. Raw counters from both the switches and even the RBS nodes are aggregated to provide statistical information on a variety of areas from call setup and handover performance to call terminations.
Optimization engineers use this information to identify worst performing cells in the network and with the appropriate analysis of base counters, are able to identify, in some cases, the root cause of the problem cells.
Statistical information is usually provided by the network equipment vendor from their Network Management System (NMS) or 3rd party solutions.

1.2.3 Monthly Processes

1.2.3.1 Benchmarking Integrity Check (Optional)

In some cases, Operators also opt for monthly (or quarterly) benchmarking exercises based on drive test data. Data and reporting from such exercises allows the Operator to measure their competitiveness in their regions or countries. In certain cases, and more so in the present time, market regulatory requirements often states benchmarking as a necessary part of the Operator's activities which is then used to ensure compliance with local regulations and policies.

Enhanced Quality Management

Enhanced Quality Management Processes are those processes which are needed to be done to introduce more proactive quality management. It involves obtaining more perspectives on quality issues such as obtaining and reviewing customer complaint data as well as strategic planning for coping with capacity increases in the medium term. The frequency of such activities vary, with the following providing a pragmatic approach in a typical Operator environment.

1.2.4 Bi-weekly Automatic Drive Test Review

Whilst network statistics provide a quick view of network performance, it is difficult to understand the (individual) subscriber's experience of the network. Assuming that an Operator's subscribers significantly utilise their mobiles on the road, drive-testing provides a very good idea of a subscriber's experience if the QoS issues are geo-located in the same vicinity. Automated drive tests provide hugh amounts of data which can be used to identify these QoS hotspots. With the advent of geo-located mobile traffic recordings, this would be another avenue to identify such QoS hotspots which impact subscriber perception of the network.

1.2.5 Monthly Customer Driven Network Quality Review

Whilst in the past, CRM systems have been disjoint from Optimization, more and more today the quality management processes include direct feedback from the CRM system. Customer tickets provide a relevant input to the optimization process by high-lighting weak spots in the network and prioritising problems that need to be addressed with urgency. A Customer driven Network Quality Review aims to do just that by ensuring areas, whether geographical, logical or processes are continuously reviewed and improved.

1.2.6 Yearly Optimisation Strategy Review

On a yearly basis, as the network expands and grows, it is important to always review and update optimization policies and strategies. Such reviews and audits ensures that the optimization department can keep pace with network growth to always meet its primary objective of maximizing quality for the subscribers.

Specialised Quality Management

Specialised Quality Management Processes are those processes which are aimed at looking at the longer term quality or capacity issues of the network. Feature and specific Parameter Testing as well as new Service Launches fall into this category. These processes are not daily processes but are required on an ad-hoc basis when network quality or capacity issues demand. These ad-hoc processes can be launched when, for example, the yearly optimization Strategy Review indicates a need for them. Other processes unique to each Operator such as VIP Route Troubleshooting will also fall under the Specialised Quality Management Processes.

PART II

Network Parameter Management

2 The Need for Network Parameter Management

Network Parameter Management fulfils the need in a dynamic network environment to ensure that parameters in the cellular network are consistent within vendors, between vendors and also between technologies such as 2G, 3G and 3.5G.

The following problem descriptions and scenarios explain in more detail the need for Network Parameter Management.

2.1 Managing Parameter Consistency

On a day to day basis, the parameter databases in network nodes are constantly updated and modified due to operational issues and optimization work. As time goes by, as parameters are modified, inconsistencies can creep into the database due to overlapping activities, the difficulty of coordinating across departments and sometime, simple human error.

Take a simple scenario outlined here.

A network configuration as seen in Figure X below is described.

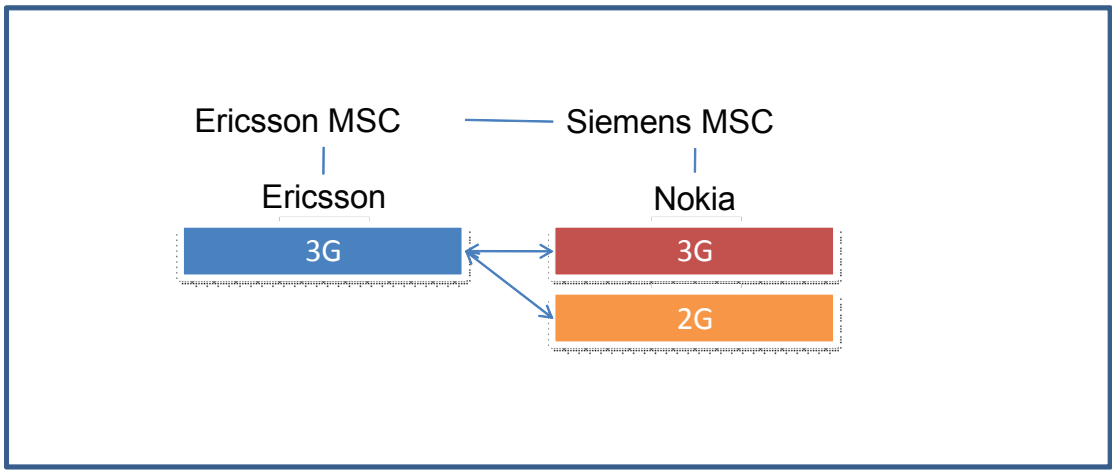

Figure X:

The example network configuration is a Nokia 2G/3G RAN network connected to a Siemens MSC and an Ericsson 3G RAN connected to an Ericsson MSC.

When implementing a simple parameter modification, for example, a (Ericsson) neighbour addition to a Nokia 2G cell, multiple steps need to be done to be implemented.
1.Add the Ericsson neighbour to the Nokia Cell neighbour list as a 2 way neighbour with correctly defined BCCH-BSIC
2.If undefined, create an external cell definition in the Ericsson RNC.
3.Add the Nokia Cell to the Ericsson neighbour as a 2 way external cell.
4.If undefined in the MSC level, add the LAC for the target cells.

Up to 4 steps is required for updating a single parameter due to the requirements of each vendor and the technology type. With many parameters being updated every day, the possibility that some error is made in this process is high. Furthermore, conversion of change requests to MML scripts is, by and large, a manual process which is also prone to error. The complexity and number of MML scripts required also increase with the number of increasing nodes, technology types and vendors. Failure to manage this situation can lead to an inconsistent parameter database which can lead to more dropped calls in the system.

One of the software solutions to manage this would be to automate the creation of all MML scripts for all parameter change scenarios. However, it is in the opinion of this author that such a system, if conceived, would be highly expensive due to the very large number of scenarios possible. The alternative is to use software to only detect and correct the inconsistent parameters in the system, a so-called check and balance for the network.

2.2 Intra and interdepartmental coordination

Here is another example of a possible scenario that could lead to inconsistent parameters in the network.

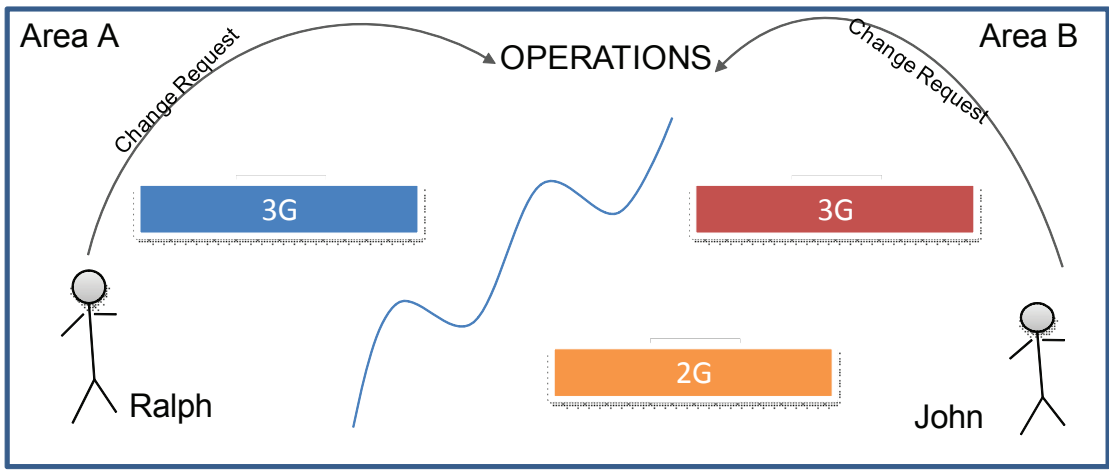

Figure Y:

In a typical operator environment, optimization engineers are responsible for specific areas / vendors and/or technologies. In the case in Figure Y, Ralph is the Optimization engineer for Ericsson 3G and John, for Nokia 2G-3G.

In a day, Ralph may choose to optimise Area A at the border, changing parameters based on his understanding of the network at the time. He may have also already communicated with John who would have told him that he has already changed certain parameters at the Nokia border, which he assumed had been changed as they were previously submitted. Ralph may proceed to submit his Change Request to optimize his border areas. At Operations, both Change Requests are implemented, however, not necessarily in the order that both Ralph and John envisaged. As there is no in-built multi-vendor check at the OSS, both Ericsson and Nokia systems accept the changes.

Whilst such a scenario may seem trivial, such changes do introduce inconsistencies in the network. If the change does not immediately cause any dropped call, a series of uncoordinated events such as this can lead to parameter databases which are very inconsistent and lowered QoS in the long run. As the QoS degrades gradually, departments do not immediately detect that it is inconsistencies in the parameter database that is the cause.

There are 2 ways of managing this. The first would be strict adherence to intra and inter departmental processes and communication. However, even with such discipline, it is still possible for errors to be made, as in any complicated process. A more pragmatic approach then would be to have a check and balance system that can detect when such inconsistencies occur in the network.

2.3 Rehoming

In another scenario, a rehoming exercise is carried out as in Figure Z below.

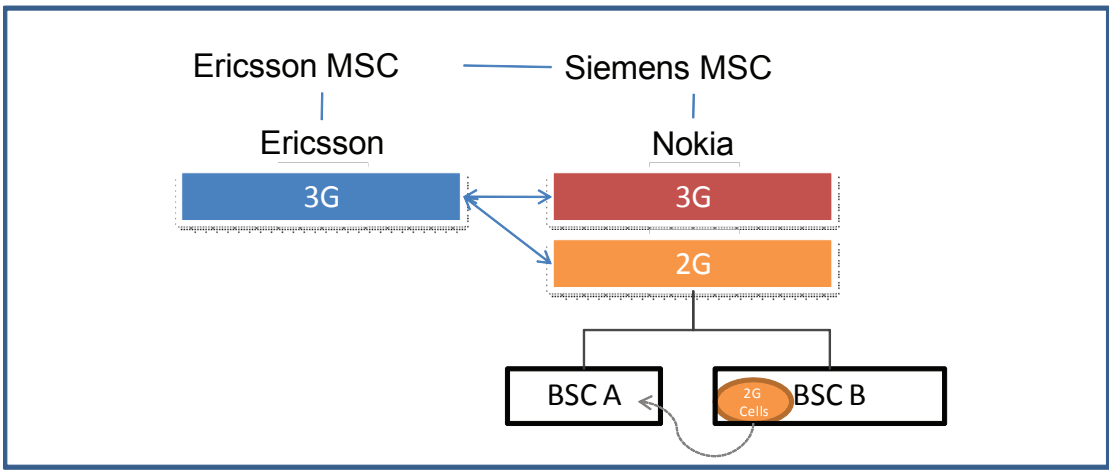

Figure Z: Rehoming example

The rehoming (or reparenting) exercise for operators occurs during the early morning maintenance window or when the traffic is lowest so as not to disturb subscribers, who expect no change in the QoS they receive. However, this is not always the case as in the process of cells migrating to a new BSC (or RNC), a large number of reconfiguration changes are made both physically and configuration. Careful checks need to be performed in both areas. In the latter, a large number parameters need to be carefully checked to ensure consistency in the new network configuration. This is another area where a network parameter management solution incorporating consistency checks is useful.

3 High Level Solution for Network Parameter Management

An adequate solution for network parameter management which ensures consistent parameters in the mobile network should have the following features:

- **Be fully automated for scheduled daily checks**

  Parameter checking needs to be done daily to ensure parameters are consistent even with new sites coming on air and /or any network changes occurring during the previous night hours.

- **Be departmental-wide or enterprise level**

  All optimization engineers and managers should have access to the parameter software. In an ideal situation, other departments could have access with different authorities set for different groups of users.

- **Be multi-vendor and multi-technology**

  The software has to have the ability to check parameter consistency between as many vendors and technologies as possible.

- **Easy to use**

  The software should be intuitive to use for an optimization engineer.

- **Provide cell histories**

  Cell histories provide optimization engineers the history of parameter changes in the system. This helps in planning optimization strategies and provides a check and balance for inter-departmental processes between the Optimization department and the NOC.

- **Provide excellent reporting and export packages**

  With a strong reporting package, Optimization Engineering management can control the changes in the parameter database and its impact on the network quality. With exports to various easily available formats such as Excel, Optimization engineers can do more post-processing, if required, for their own analysis.

- **Semi- or automated inconsistency corrections**

  Apart from detecting inconsistencies, a good solution will need to be able to correct inconsistencies either in a semi-automated or automated manner. Semi-automated solutions will serve the change management process better where it provides an approval point for engineers to confirm the recommended changes are in line with their engineering design.

- **Inherently support change management**

  Support for change management is a pre-requisite. With in-built change request management, the solution can automatically control unauthorized changes to important parameters (optimized parameters) in a closed loop manner.

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