



# Intelligent Optimization:

Advancing Optimization in 3G Networks to Enhance Service Quality, Network Efficiency, and Business Performance Through User-Centric Data Analysis



Managing network complexity, accommodating greater numbers of subscribers, improving coverage to support data services (e.g. email, video, and music downloads), keeping up to speed with fast-changing technology, and driving maximum value from existing networks – all while reducing CapEX and OpEX and ensuring Quality of Service (QoS) for the network and Quality of Experience (QoE) for the user. These are just some of the pressing business issues faced by mobile service providers, summarized by the demand to “achieve more, for less.”

In response, operators are increasingly turning to advanced optimization technologies. These provide a picture of the actual end-user experience to make more accurate decisions about how to enhance, and squeeze utmost value from, existing infrastructures. In this analysis, Mark Holdsworth, Manager Business Development, EMEA, Motorola, reviews in greater detail the market trends behind the growth in demand for user-focused end-to-end network optimization. He moves on to explain how intelligent processes devised for 2G systems are being refined and applied in 3G networks to: smooth the transition to UMTS 900 and ensure that 3G networks are designed correctly first time to support the launch of new services, to provide a high-quality user experience to drive revenues, and reduce the Total Cost of Ownership (TCO) of the network.

## The optimization imperative

UMTS network deployments are gathering pace; at the start of 2008, there were 203 UMTS networks in operation across 85 countries around the world with 67 more systems either in planning or deployment stages. And, service providers, whether a 2G network operator planning the launch of 3G systems or an operator with existing 3G architecture, face an important issue: how to protect QoS for the network and QoE for the user when demand for broadband data in particular is spiraling. Revenues from data (excluding SMS) exceeded \$10bn in the first quarter of 2007 alone.

Furthermore, it's predicted that over half the world's Internet users will use their mobile phone to access the Web by 2011. And when estimating the overall market for 3G services, Informa Telecoms and Media projects that, by 2012, there will be 1.3 billion UMTS/HSPA connections. The challenge for service providers is that, just as they demand clear calls, subscribers will expect promised data performance rates to be achieved.

3G service providers must therefore squeeze optimum data capacity from increasingly complex, multilayered systems. Many of our customers report that they must achieve this goal while balancing other vital commercial demands – especially the expectation that efficiencies in the network and across the business must be generated to cut TCO against a backdrop of an increasingly competitive environment. Technology is a flexible and innovative ally in the drive to address these challenges, especially when it comes to the new intelligent processes to optimize networks that are discussed below.

## The QoS imperative: Maintaining 2G network performance while deploying UMTS 900

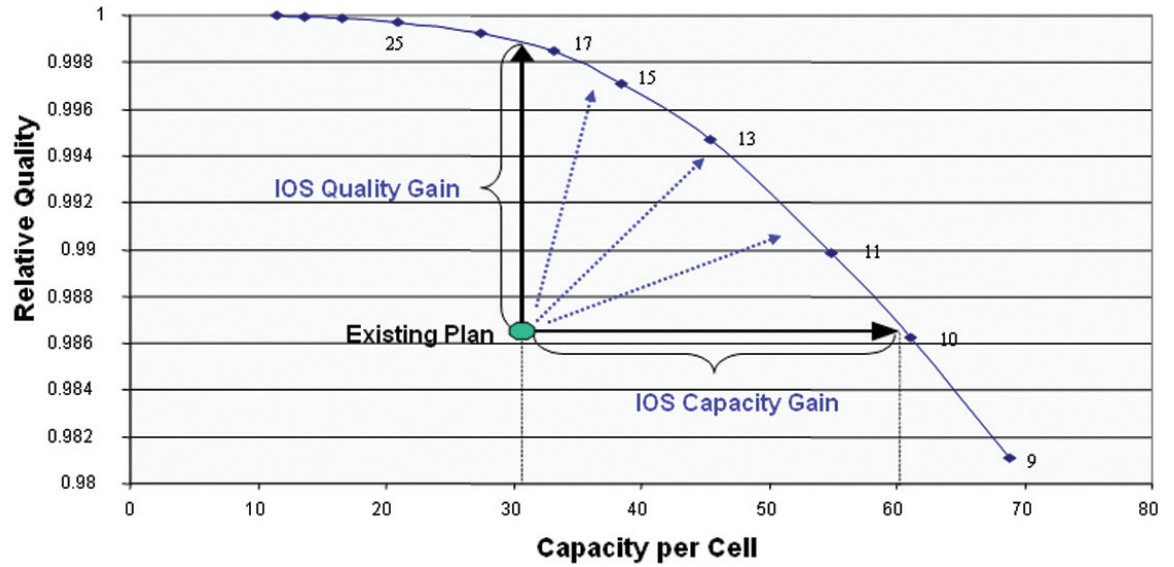
A critical breakthrough in the drive to enhance optimization is the capture of Measurement Reports (MRs) to analyze and make improvements to network performance. MRs are automatic status updates sent from subscriber handsets every 480 milliseconds. The information provides billions of records per collection period, providing an accurate picture of the RF landscape and the real user experience.

## Optimization: Essential capabilities to expect from potential partners

**Whatever network a service provider operates, we've identified a "must-have" list of capabilities that either we believe are essential to improve network performance or are regularly asked for by customers. These include the ability to:**

- Ensure geo-location of subscriber data to accurately identify both outdoor and indoor network traffic distribution and QoE so as not to over-dimension for outdoor use
- Maintain and manage the GSM KPI performance for QoS and QoE while de-risking the deployment of UMTS 900
- Be "vendor neutral"; so that performance improvements can be applied across all vendors' infrastructure
- Automatically collate end-user data from a total end-to-end network view to support informed and rapid "time to performance" changes
- Provide solutions to optimize all areas of the network especially where high density challenges exist
- Guarantee risk and reward: Optimization partners should be confident of improving networks to such an extent that they will accept risk and rewards terms based on meeting predefined KPIs for QoS and QoE.

## Balancing Quality Vs Capacity for an Optimum Plan



When refarming spectrum, service providers are faced with the challenge of ensuring that the QoS for existing 2G customers is not impaired. We believe that the best way to address this issue is to maximize spectrum efficiencies in 2G systems. This ensures that, when spectrum is reallocated to 3G, there is no noticeable drop in service performance. By reviewing MR data, we provide detailed insights into coverage, signal strength, noise level, subscriber locations, and typical service usage patterns. Accurate data means tighter frequency

planning allowing an operator to recover frequencies currently being utilized in the 900 MHz channel and reallocate them to UMTS 900 MHz services. The depth of intelligence identifies how the network's design can be optimized to ensure that spectrum can be transferred without impacting the 2G user experience. This frequency planning approach, using raw MR data, is essential for service providers who are planning to implement UMTS in the 900 MHz spectrum.

## The TCO imperative: Ensuring the migration to 3G networks is deployed right the first time

While Automatic Cell Planners (ACPs) can be highly effective in designing effective networks, the system is only as good as the predictive user data on which planning decisions are made. If poor data is used, the result is usually of little practical value when building a new network.

But with detailed MR data gathered from existing 2G subscribers inputted into ACPs, highly informed decisions can be made about infrastructure design. This ensures the network is deployed accurately first time to meet the expectations of end users, and provide the foundation to scale in the future as required by KPIs. The design is validated by field testing and MRs that indicate problems with coverage holes, pilot pollution, and server deficiencies, which can be adjusted to ensure optimum performance. The TCO payback of using business optimization as a tool to formulate the design of UMTS networks can be extensive.

Typically, at the initial stages of planning, decisions are based on predictive data. This is often inaccurate. Then, as the network evolves to support new services or enhance capacity, multiple system iterations are introduced by different engineers using different skill sets and tools. In our experience, these issues often result in networks with excessive overlap and an increased site count. The cost impact of too many sites in non-optimal locations is in turn exacerbated when considering the expense of site rentals, site maintenance, site utilities, transmission, and maintenance staff.

## Intelligent Design and Growth Planning (IDGP)

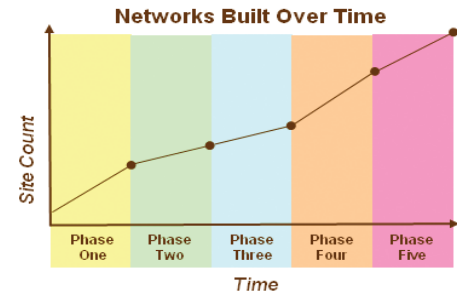
Motorola's IDGP collects subscriber measurement data and uses an advanced algorithm to perform MR geo-location that fully reveals traffic distribution. On the basis of the MR geo-location technology, IDGP develops various GSM network design and optimization features so you save time and effort in designing and maintaining your networks at optimal levels. IDGP delivers major CapEX and OpEX savings whether a network is being built from scratch or optimized. For instance, it's not unusual on a major network for the IDGP to recommend that hundreds of base station sites are removed when upgrading systems from 2G to 3G.



# Effect of Networks Built over Time



- > Multiple planning iterations by many engineers with differing skillsets using manual techniques
- > Year-on-Year 'Point Solutions' to address Capacity and Quality issues
  - ▶ Sites added but usually not removed
    - Driving an increased site count
    - Leading to excessive overlap
  - ▶ Planning using Prediction based model...
    - Possible errors of +/- 6-9 dB in urban areas
  - ▶ Planned using a simulated traffic distribution
    - Traffic/Capacity imbalance
    - Subscriber blocking
- > Net Result
  - ▶ Areas of High Interference
  - ▶ Areas of Poor Dominance
  - ▶ Areas of Poor Speech Quality
  - ▶ Areas of Poor Quality
  - ▶ Increase CapEX and OpEX



**Acid Question: If the network was designed as a greenfield today given the same traffic loading but with updated techniques would the site locations be the same?**

Therefore, the acid-test question for operators to ask must be: "If the network was designed today, using updated techniques such as automated measurement reports and microcellular alternatives, would the site locations be the same and would there be as many sites?"

This question represents an opportunity. With the extended life of GSM and the future of UMTS, accurate design and planning using the best technology available can generate a range of financial benefits by reducing site count, moving sites to cheaper rental alternatives, reviewing site alternatives not available during the original planning, and expanding sites using greater fractional reuse.

From a TCO perspective the savings are huge if the network is designed right first time compared to multiple iterations. In fact, we recently enabled a European operator to reduce the number of cell sites on their 2G network by 300. A conservative estimate of the cost saving for each base station (based on equipment cost and supplementary expenses such as maintenance and site rental) is estimated at \$1 million over the network's predicted eight-year life cycle. The overall saving equates to \$300 million in CapEX and OpEX.

## The QoE imperative: Enhancing the 3G user experience

Where networks are already deployed, service providers with existing 3G infrastructure can enhance customers' experiences of combined voice and data services by focusing on three key factors: first is the RF system. Second is end-to-end network performance. And third is content / applications. We have designed systems to enable the automatic capture of a range of operational analyses accordingly including:

- **Automated RF assessments:** Using a combination of probe and counter data generated automatically, the RF environment can be assessed to tune pilot power. This will reduce interference and strike a better balance between capacity and QoS in line with designated KPIs.
- **End-to-end network performance:** End-to-end automated network assessment provides information on the performance of key systems such as the Gi interface, SGSNs, and content servers. MRs are collected to measure subscriber behavior, their geolocation, and the real end-user experience. Every service can be evaluated to ensure the end user was able to initiate a data session, the information was delivered at the right speed, and the session was completed as expected.
- **Content:** With data services increasingly enjoyed by end users, optimization techniques will play a critical role in efforts to reduce latency. The goal is to ensure that key activities – such as web surfing – deliver a quality experience to drive revenues. Network analysis can reveal scope to increase bandwidth and track most used content to predict how new data compression techniques can make best use of capacity. Also, operators can analyze how adapting content impacts the user experience across all devices from smart phones to laptops and mass-market devices, providing the scope to tier tariffs based on the KPIs that can be achieved by the customer's primary device.

### The importance of end-to-end, customer-centric data analysis in enhanced optimization

Service providers should assess if test methods are fully compatible with multi-vendor networks and, importantly, should review the entire infrastructure – not just certain elements such as the RAN or network core. In addition, analysis of real subscriber traffic usage and location are critical. Only when a complete view of performance is available – especially at the end-user level – can the right decisions be made on how best to efficiently manage spectrum allocation, optimize services, launch new products, and cost-efficiently expand capacities where required.



## The automation advantage

The comprehensive nature of the new optimization techniques we have developed, based around MRs, allows revisions to be made to the complete network in one cycle to achieve return on investment (ROI) more quickly. Automation reduces the costs of data collection and collation while improved utilization of existing resources and more effective planning of new systems achieves two key objectives: TCO is cut and a strong customer experience (for voice and data) is guaranteed (reducing churn and extending loyalty).

Furthermore, the provision of constant, detailed, and timely data provides a new perspective on network performance. Take operations teams – with close to real-time data they are quickly aware of changes in coverage quality and service, can identify sites that may be obstructed by physical architecture changes, and can rapidly and precisely locate where new sites are needed. Also, they can better predict, prepare for, and respond to the impact of major events on network performance such as sports fixtures or concerts. And of course, the risk of introducing new products can be mitigated. With the ability to perform “if then else” rollouts, using real-world data and automated tools, any negative effects on the user experience will be immediately apparent (as will the CapEX requirement) when introducing new offerings.

In discussions with service providers, it's clear that more detailed and comprehensive approaches to network optimization are highly valued. The level of intelligence achieved by the latest optimization

systems provides the evidence that networks need to fine-tune not just their systems but their businesses too. By enhancing processes, from operations to marketing and customer service, service providers can apply optimization data to make decisions that drive cost-efficiencies, profit from successful new services, and enhance customer loyalty. We are now refining the techniques to enhance network performance into the future too.

## Optimization in next generation networks

Motorola has unparalleled capabilities to implement end-to-end optimization systems. The main features of our advanced optimization systems, including automating data collection, analysis of multi-vendor networks, and a close to real-time comprehensive overview of network performance, are being integrated into our new systems for assessing next generation networks like WiMAX, HSPA, and LTE systems. We are also extending our commitment to subsume the “risk” of optimization (by being remunerated based on KPIs) to 4G networks.

As these new technologies come to market, Motorola's network design and planning services will deploy real subscriber data from 3G users to ensure that networks are accurately designed to meet the demands of, and profit from, the new generation of high-speed data users.



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