Turning Up in a Downturn

How to get more 3G out of less.

How did we get here?

While mobile telecommunication has proven to be one of the industry segments least impacted by the 2008-2009 economic crisis, carriers around the world are still being cautious. They are slowing down operational spending rates and infrastructure investments. While mobile telecommunications has gone through some dramatic cycles in recent years, the fundamentals of the industry are noticeably different in 2009.

The steep rise of the mobile telecom industry in the 1990s, peaking in 2001, was created by an irrational overspend in the telecommunication infrastructure kick-started by the dot.com and 3G hype. When the bubble burst, a serious imbalance between supply and demand became apparent. The 3G business model collapsed. The immature 3G infrastructure, overshooting 3G license costs, and the lack of 3G-terminals, 3G-applications and customers lead to operators and equipment manufacturers losing hundreds of millions. After a slow recovery in the following years, the mobile industry consolidated in 2006 with two tier-1 NEMs (Siemens and Lucent) disappearing in mergers.

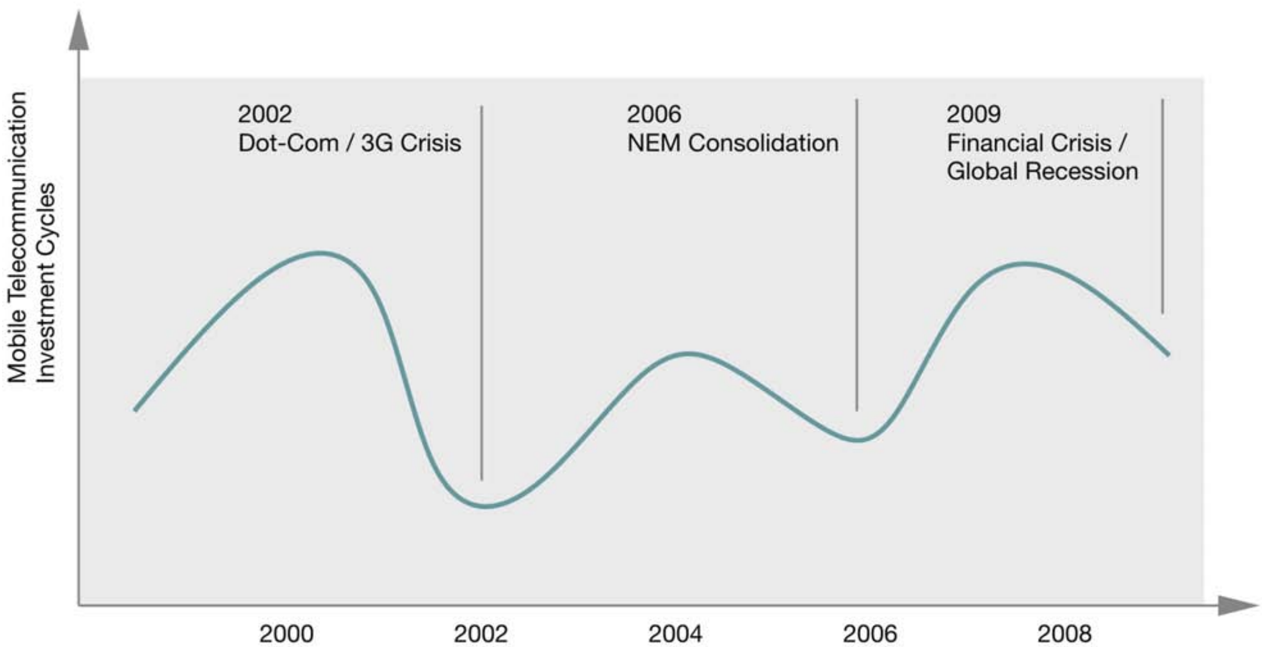

Figure 1. Mobile industry investment cycles 1999 – 2010 (Tektronix Communications Test & Optimization Strategic Marketing 2009)

The Rise of Mobile Broadband

In 2008, the transformation of mobile voice networks to true mobile broadband infrastructures was kick-started with the launch of the Apple iPhone 3G. Within weeks, the volume of high-speed mobile data traffic increased exponentially. In the first HSPA coverage areas, mobile broadband traffic started to exceed voice traffic, with more than fifty percent being iPhone traffic. The launch of competing iPhone-like terminals at the end of 2008 gave a further boost to mobile broadband traffic, bringing the underutilized 3G infrastructures to their maximum capacity. By 2010, mobile broadband subscribers are expected to outnumber fixed broadband subscribers and this is only the beginning. With a CAGR of 131 percent, mobile data is expected to reach two exabytes per month by 2013 – a 66 percent increase over 2008.

Because one iPhone or an iPhone-like smartphone generates as much traffic as 30 voice/SMS type mobile phones, and a laptop aircard as much as 450, by 2013 mobile broadband will drive more than 80 percent of all mobile traffic (Figure 3).

Much of this traffic will be delay sensitive since it will be video content. In 2009, video transport via the Internet will be responsible for more than 25 percent of all global traffic, a share that will rise to 50 percent by 2012. For mobile broadband, a similar distribution is expected.

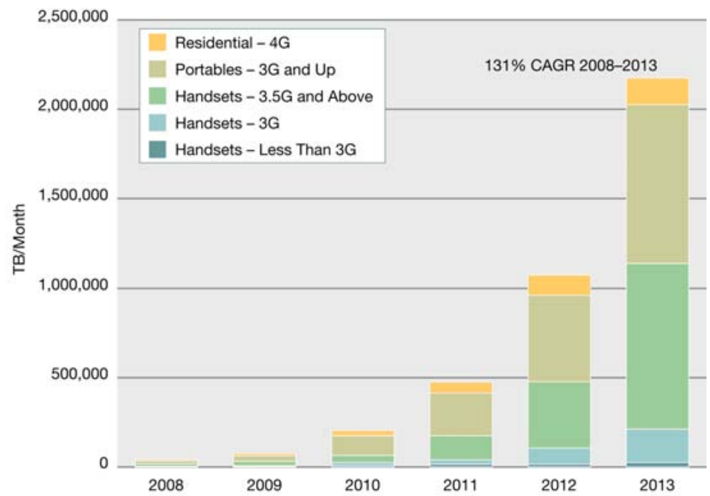

Figure 2. Mobile network data traffic per month: 2008 – 20012 (Cisco Visual Networking Index 2009)

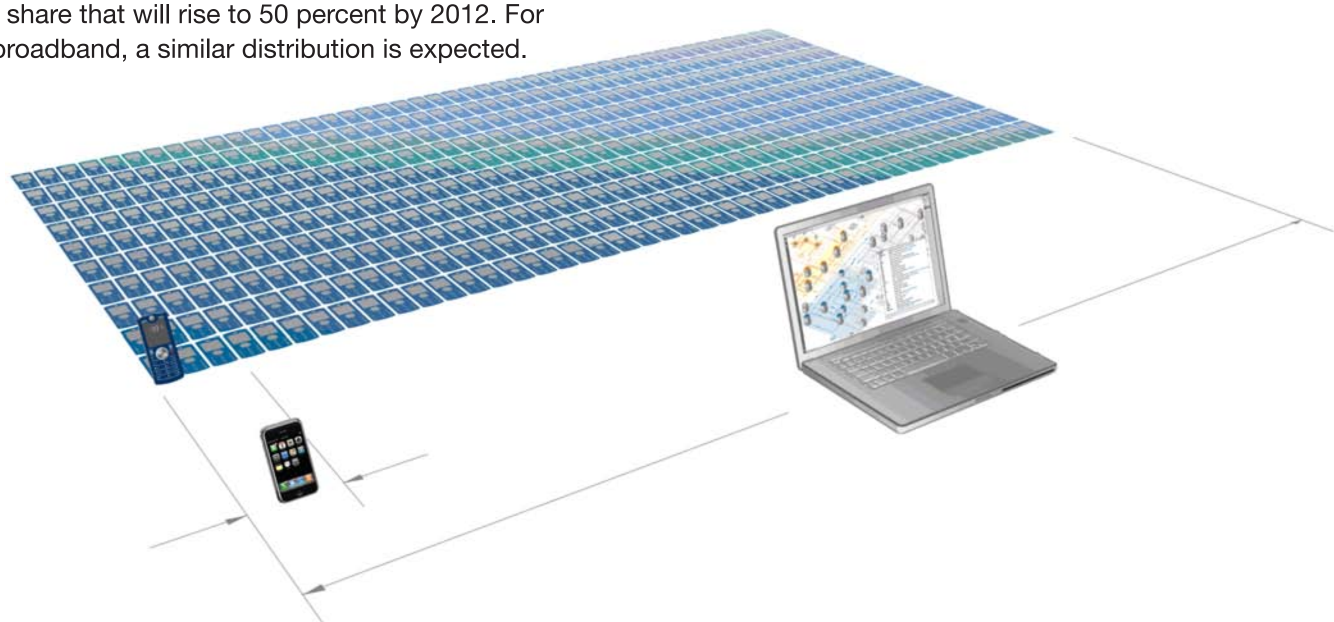

Figure 3. Mobile network traffic: Smartphones / Aircards versus Voice / SMS Mobile Phones

The Transformation of Mobile Networks

This rise in mobile content is having a serious impact on mobile communication networks. Now for the first time, these networks are becoming true multi-service infrastructures. For twenty years, mobile networks carried a single service: voice. And as recently as 18 months ago, the same could be said for 3G networks. Most of the focus in operations, maintenance and optimization was dedicated to the control plane. Things like cell selection, call setup performance, call drop ratios, hand-overs or roaming were the priority. And the only thing to worry about with the user plane was voice quality. But now priorities are changing on a major scale. The same transport infrastructure has to carry multiple services with significantly differing needs for bandwidth, response time or latency. Whether it is a music download, an email-transmission, a street-navigation application, an e-commerce transaction, a video-stream or a voice call, the network needs to be aware of the transmission needs for various services and operate accordingly.

And unlike fixed networks, in the mobile world, you cannot throw bandwidth at the problem. Transport capacity in a mobile network – especially in the Radio Access (RAN) is a scarce resource. This is why scheduling and quality-of-service (QoS) mechanisms (which reach from the transport infrastructure to the individual services, as well as from the core network to the terminals) have to be operational. While 3G and 3.5G networks were originally designed to do exactly this, many of the related mechanisms have never been implemented, activated or even tested.

Network Optimization 2.0

For many years, optimizing a mobile network was a relatively static activity. In 2G networks, the focus was on frequency management across neighbor base stations. In 3G it was all about finding an optimal balance between coverage and interference. When capacity limits were reached, upgrades of power amplifiers or the addition of sectors at the base station were the solutions of choice. This has been and is still working well in a mobile voice-dominated network.

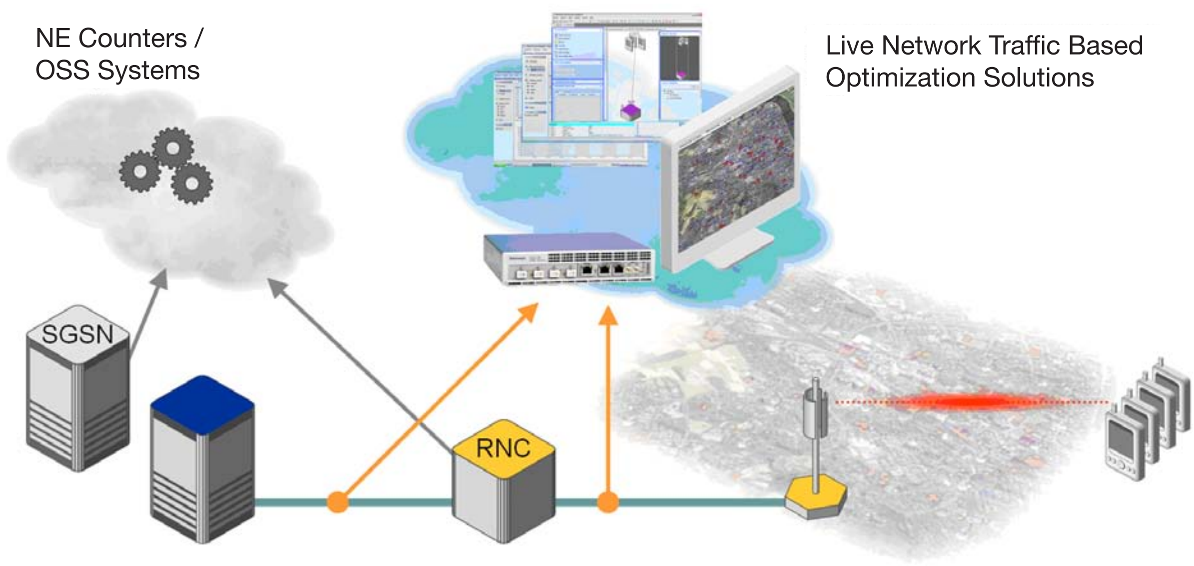

Figure 4. Geo-location-enriched live network traffic based optimization system (Tektronix Communications OptiMon)

But it no longer works in a mobile network because it must carry true multi-service traffic profiles. It is because of this that the entire approach for tuning the network must change. The optimization focus moves away from the control plane to the user plane, which is becoming the main driver for network command and control procedures. Rather than assigning an equally high-quality radio channel to each terminal and in the backhaul reserving 64kBit circuit-switched voice tunnels through the network, things are becoming significantly more dynamic (and more complex). Depending on the type of service and the actual traffic profile of that service, tailored network resources need to be assigned or released within seconds. This can only be done by combining efficient packet scheduling and buffering strategies with end-to-end network and user-plane QoS mechanisms. The processes themselves then need to be looped back to state-of-the-art antenna technologies such as MIMO and Beam-Forming. Instead of manually or semi-automatically changing antenna tilt or azimuth, MIMO antenna arrays can change their direction and electronically beam within seconds. They are able to react in real time to new traffic sources or drains by dynamically adjusting transmit and receive capacity in order to better manage coverage. The traditional optimization tool – drive test – will fail in such an environment. The problem of under-sampling just a few active drive test calls is reaching a point at which drive test data becomes meaningless, and in many cases misleading. Not only can the artificial sample calls of a drive test system not reproduce the traffic mix of a mobile broadband network, but the results of these few test calls simply are no longer represent the operational state of a cell, especially when the transmission and reception conditions in a sector are continuously changing.

The only meaningful way to optimize these networks is to extract the necessary data for optimization (radio parameters, control plane, user plane) off live network traffic. If the data is then enriched with the geographic position through geo-location algorithms, an optimization infrastructure can be built which will maximize the performance of the network while reducing the traditional, low-impact and now wasteful activities such as excessive drive tests and on-suspicion type infrastructure upgrades.

A Real World Example: Getting More out of Less

So let's take a closer look at a real world example. Figure 6 gives an overview of the CAPEX and OPEX distribution of a typical 3G network operator with 5 – 10 million 3G subscribers. In a recent project with such a customer, the deployment of a live network traffic-based optimization system with geo-location capabilities – Tektronix Communications' OptiMon – for each RNC achieved annual savings of more than 800,000€ per RNC.

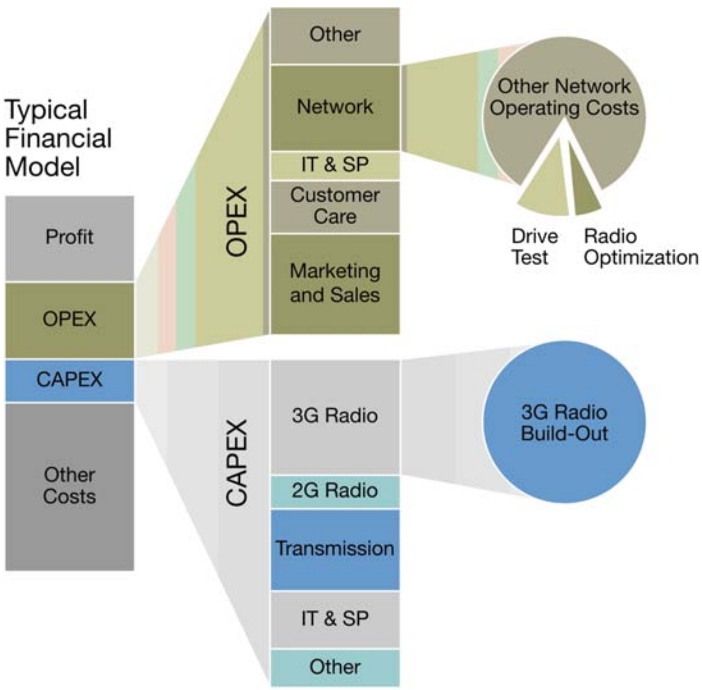

Figure 5. Typical 3G operator CAPEX & OPEX distribution

The distribution of the savings across the various OPEX- and CAPEX-related cost positions was as follows:

Optimization Process Reduction of drive test Higher efficiency for optimization engineers Better success ratio in assigning activities	220K€
Reduction of QoE issues/ churn due to pilot pollution	120K€
Optimization of uplink interference issues	26K€
HSPA throughput improvement	36K€
Active Set size optimization	130K€
UTRAN upgrade improvements	21K€
Selective linear power amplifier upgrades	45K€
E1 capacity planning	224K€
Total savings per year per RNC	> 820K€

These results can be achieved by taking a radically different approach for network optimization: conducting geo-location-enriched network assessments based on live traffic at the central location where every call is aggregated – the RNC.

Find out how much you can save using Tektronix Communications' **OptiMon Calculator.**

Where do We Go from Here?

The mobile ecosystem is transforming at fast pace. The evolution of mobile networks from single-service, circuit-switched voice networks to multi-service packet-switched networks is taking place at breathtaking speed. In a highly competitive market such as mobile communication, throwing money or bandwidth at the challenge is not an option.

In today's uncertain and ever-changing economy, smart use of existing resources based on a true understanding of what is going on in the network today, where we are heading and what exactly needs to be done is critical. This type of business strategy will enable you to turn up…even while in a downturn.

Sources:

Cisco, January 2009: Visual Networking Index: Global Mobile Data Traffic Forecast

UMTS Forum, February 2009: Mobile Broadband Evolution

Infonetics February 2009: Fundamental Telecom/Datacom Market Drivers

Tektronix Communications' Test & Optimization October 2008: Reduce Drive Test Costs and Increase Effectiveness of 3G Network Optimization

Tektronix Communications' Test & Optimization March 2009: OptiMon: Business Benefits of Deploying Advanced RAN-Based Optimization Techniques

About Tektronix Communications:

Tektronix Communications provides network operators and equipment manufacturers around the world an unparalleled suite of network diagnostics and management solutions for fixed, mobile, IP and converged multi-service networks.

This comprehensive set of solutions support a range of architectures and applications such as LTE, fixed mobile convergence, IMS, broadband wireless access, WiMAX, VoIP and triple play, including IPTV.

For Further Information:

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology.

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