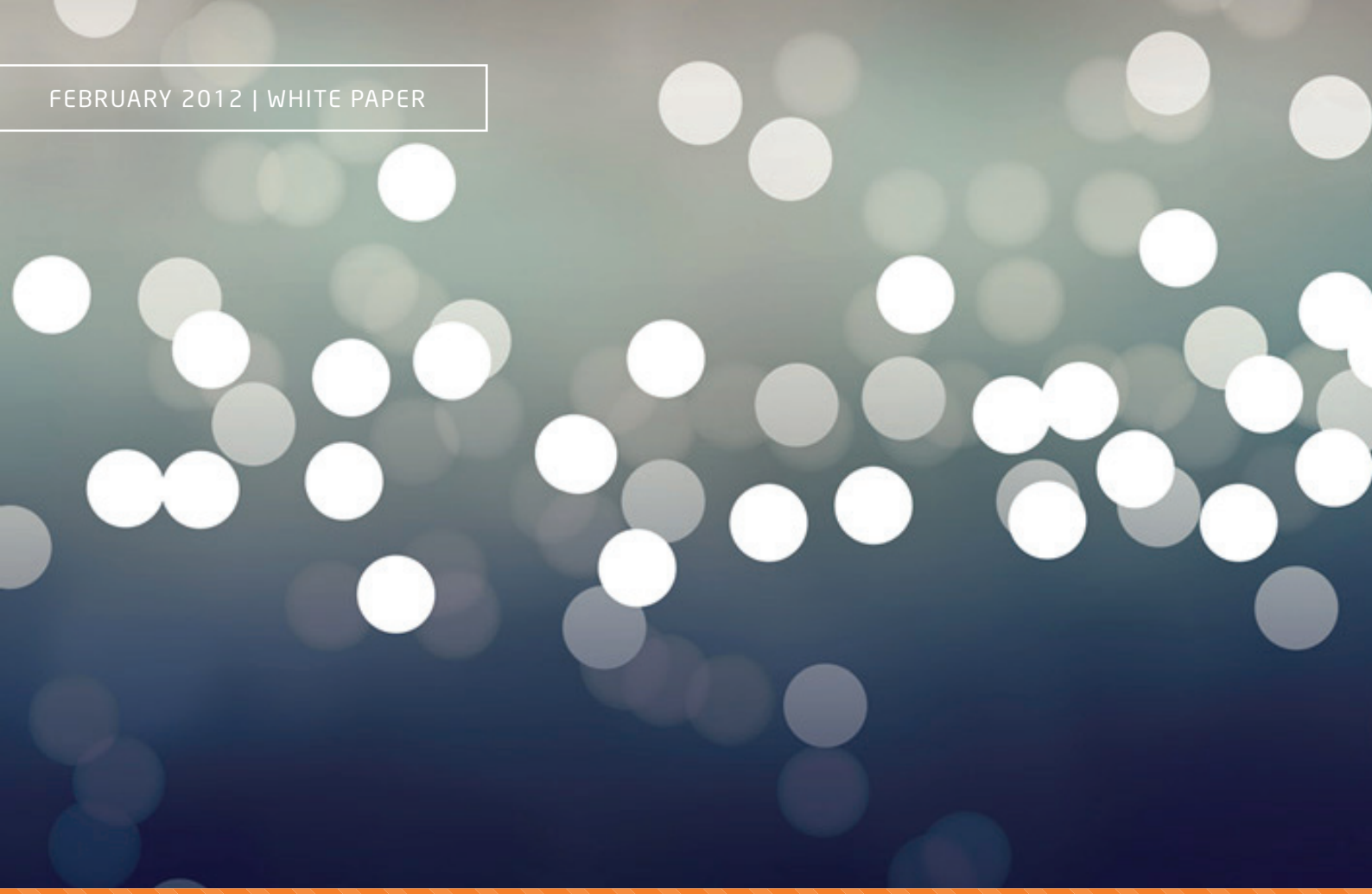


FEBRUARY 2012 | WHITE PAPER

Getting ahead in an LTE World

PRODUCED BY

telecoms.com

SPONSORED BY

AIRCOM INTERNATIONAL

SYNOPSIS

Operators around the world are facing tremendous challenges in terms of growth in data traffic, operational efficiency and customer experience. In order to address these demands, further attention and financial investment are being directed to the upgrade of existing network infrastructure—and with peak download speeds of 100Mbps and above being promised, LTE has been widely hailed as the solution to operators' congestion troubles.

This white paper addresses the issues that will be faced by carriers already planning to deploy LTE technology over the next year, as well as any organisation planning to embrace mobile broadband as a principal service offering in the future. The data boom is upon us and anything that can be done to positively impact the future status of the network should be done today.

INTRODUCTION

HSPA and HSPA+ are now both commonplace but, even with such advanced technologies in use, pressure on spectrum resources will continue. Therefore operators must deploy the most efficient technologies available to them—and LTE is the clear and natural migration path for GSM, CDMA and even WiMAX operators.

There are several key reasons for this: The technology allows operators to modernise their legacy radio architecture, reduce the cost of mobile data, increase capacity, and create new revenue streams. SingleRAN technology, incorporating a software defined radio (SDR) device, has also made a significant contribution to the rapid rollout of LTE, allowing operators to support multiple communications standards on a single network through a consolidated set of hardware components. Operators only pay to activate the cards they require, accelerating the deployment and upgrade process.

As a result of such compelling motivation, LTE is enjoying the fastest ever uptake of any cellular technology to date, benefiting from the commitment and drive of dozens of major carriers, an unprecedented level of cross-industry collaboration and the successful implementation of lessons learned from the rollout of previous technology generations. By the end of 2011, the number of LTE connections worldwide had reached over 6.4 million, with more than 49 networks having launched commercially since Nordic carrier TeliaSonera got the ball rolling in December 2009.

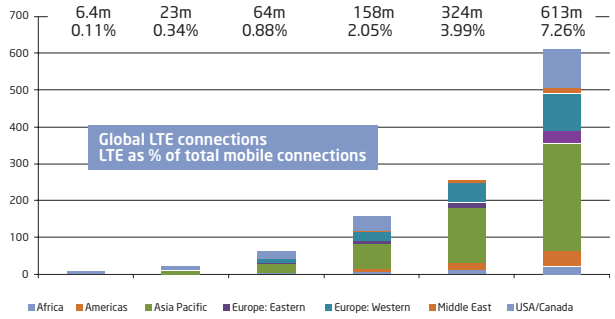
A total of 285 operators have committed to commercial LTE network deployments or are engaged in trials, technology testing or studies. Industry body the GSA has confirmed 226 firm commercial LTE network deployments in progress or planned in 76 countries, including the 49 networks which have commercially launched in countries such as: Armenia, Australia, Austria, Bahrain, Belarus, Brazil, Canada, Denmark, Estonia, Finland, Germany, Hong Kong, Hungary, Japan, Kuwait, Latvia, Lithuania, Norway, Philippines, Poland, Puerto Rico, Saudi Arabia, Singapore, South Korea, Sweden, UAE, Uruguay, USA, and Uzbekistan.

THE EARLY ADOPTERS

TeliaSonera, the pioneer of commercial LTE services noted from research it carried out in 2010, after approximately one year of service, that LTE was changing the usage behaviour of early adopters of the technology. Around 90 per cent of the Scandinavian carrier's LTE users had upgraded from a 3G connection and 54 per cent said they would not consider returning to 3G. Around 65 per cent of users acquired LTE as a complement to their fixed broadband connection, with 23 per cent downloading large files more often and 16 per cent browsing the internet more often. LTE dongle users were consuming up to 17GB per month—a significant increase on what the carrier would expect from a 3G user.

There is also a strong showing of support for LTE from the USA, where Verizon has emerged as a key engine of LTE growth. In fact, at the end of 2011, the US accounted for around 85 per cent of LTE subscriptions worldwide, with Verizon Wireless alone hitting around four million subscribers. Rivals AT&T, Sprint and MetroPCS will help the US maintain its lead in the LTE market until around 2016, according to Informa Telecoms & Media, when there will be 100 million LTE subscribers in the US compared to 613 million LTE subscribers worldwide, with the majority residing in China.

Global LTE connections by region, 2011-2016



Source: Informa Telecoms & Media

The US was one of the first countries to see multiple deployments of LTE and the technology has already changed the market's competitive dynamics. Verizon fashioned an incredibly bold strategy that saw it become the first operator in the US to launch a large-scale LTE network, differentiating from its rivals by persuading the country's increasingly data-hungry mobile users that it offers the best mobile broadband experience available. Specifically, the operator launched LTE to alleviate traffic on its 3G CDMA mobile broadband network and build a network than was better than its rivals' in delivering data-heavy multimedia services.

After the move, Verizon saw total data revenues increase by a massive $4bn in 2010 to $19.6bn, prompting Francis Shammo, Verizon chief financial officer and executive vice president, to say: "Think about that number, and then you can understand our excitement about the revenue opportunity with 4G LTE tablets, 4G LTE, and all new 3G and 4G smartphones that are coming to the market."

Meanwhile, Metro PCS's decision to launch LTE in September 2010 was based on the rise in demand for smartphones and the associated rise in data use, since the technology provides significantly faster speeds than the operator's legacy 1xRTT network. Metro PCS customers use more voice and SMS services than average, due to the nature of its unlimited offerings, and the LTE launch helped alleviate capacity constraints on its 1xRTT network.

To keep costs down, Metro PCS co-located eNode Bs with its CDMA base stations. The operator needed to use innovative technology to support its business model of unlimited talk, text and data. It uses an outdoor distributed-antenna system and six-sector cells to increase capacity by creating small picocells that maximize the network's ability to reuse frequencies, and uses dense cell sites that make it easier to maintain performance at the edges of cells.

LAYING THE FOUNDATIONS FOR COMMERCIAL LAUNCH

The reality is that LTE has already happened in many markets around the world. So what do you need to get that transition right, and when should you start planning?

The short answer is: 'now'. Even if your deployment is not scheduled until 2014 or 2016, effort invested in the project now will reap rewards later. There are three core areas that require focus: Spectrum refarming; consolidation of the network; and the use of SingleRAN and SDR to enable a fast and cost effective LTE rollout. By using the right mix of spectrum bands along with a combination of 3G/HSPA, operators can deploy highly optimised data networks capable of meeting rapidly growing data demand.

SPECTRUM

Analysys Mason forecasts that, by 2015, almost 90 per cent of worldwide wireless traffic will originate indoors. As a result, operators will need to provide good quality indoor coverage with deep in-building penetration by juggling spectrum to ensure LTE has access to low frequency bands.

In addition to seeking new spectrum in which to deploy LTE, operators are increasingly looking to existing bands as a means of supplementing coverage and capacity. One approach is to free up spectrum in bands that are already used for other services, such as GSM and HSPA, through re-farming.

By re-using existing 2G and 3G spectrum for LTE, operators can make significant cost savings, extend the lifespan of existing spectrum assets for another three years, and reduce the amount of additional spectrum they require by up to a third. While significant, these benefits can only be realised if operators follow a careful planning process to minimise service degradation for existing 2G and 3G services.

The three main candidate bands for re-farming in most regions of the world are the 900MHz, 1800MHz and 2100MHz bands, currently used for either GSM or UMTS/HSPA. In North America, spectrum at 800MHz, 850MHz and 1900MHz, presently supporting services such as iDEN and CDMA, could also be re-purposed.

Potentially more accessible as users migrate from 2G services to 3G, the 900MHz band has been proposed as an option for operators wanting to run LTE alongside GSM until such time as the 2G network can be shut down. In the interim, the use of adaptive multi-rate speech codecs and associated techniques to increase the performance and spectral efficiency of existing GSM/EDGE services can increase capacity.

Although 1800MHz is perceived to offer decent spectrum for LTE without compromising coverage, there are a number of technical and strategic issues that could make worldwide LTE implementation in the band difficult. In the US 1800MHz is reserved exclusively for Federal Government and in the rest of the world, this band is currently occupied by GSM/GPRS/EDGE services, meaning LTE will have to live side by side with second generation technology.

GSM/GPRS spectrum is still by far the biggest revenue generator for operators whether over 900MHz or 1800MHz. Until revenues from data exceed those of voice and SMS, operators will not be able to justify switching off GSM/GPRS completely. That said, it is believed that, in Europe at least, a great proportion of 1800MHz spectrum is still unused and could well be allocated to LTE.

There is also a potential shortage of spectrum, especially in countries where competition is stiff. Operators that have a small number of channels over this band will have to make substantial investments to creating more sites in order to handle the traffic growth over their networks.

SPECTRUM REFARMING CALCULATIONS

	$/MHz	GSM $/5 MHz	UMTS $/5 MHz	LTE $/10MHz	RE-FARM Total cost to re-farm 5MHz spectrum	% difference
US Operator (Tier One)	$200m	$1,100m	$2,100m	$4,200m	$8m	0.38%
US Operator (Tier One)	$190m	$1,000m	$1,950m	$4,000m	$8m	0.42%
Germany (Per operator)	$120m	$600m	$1,200m	$2,400m	$4m	0.33%

According to AIRCOM International, typical spectrum re-farming techniques are currently focused on freeing up 5MHz of spectrum that have already been allocated to 2G and 3G services, for LTE. The requirement is being pushed by the need to drive spectrum efficiency, speed up LTE deployment and cut cost through a more measured approach to new spectrum acquisition.

In order to make a fair comparison, AIRCOM has calculated the market value of 5MHz of new spectrum (UMTS column) by halving the amounts paid for 10MHz spectrum (LTE column). The percentage difference between re-farming 5MHz of spectrum is then compared to the cost of buying new 5MHz spectrum at auction today (UMTS column).

Re-farming will cost only ten per cent of the cost of acquiring new spectrum, as the table shows, which is why the vast majority of global mobile operators are contemplating it. AIRCOM also believes spectrum re-farming can reduce the bandwidth needed to operate a 2G network by up to 50 per cent, with no deterioration in network performance and user experience.

There is an important technical point to bear in mind, however. Based on its extensive experience in this area, AIRCOM advises that operators build a guard band around LTE spectrum when mixing technologies such as GSM and LTE together, in order to protect the spectrum and get maximum throughput.

INFRASTRUCTURE & NETWORK CONSOLIDATION

As they embark on LTE deployment, most operators will have 2G (GSM), 3G (WCDMA) or CDMA networks, which could lead to confusing marketing messages, diluted investments and multiple technology roadmaps. LTE offers them the opportunity to remove network build duplication and related costs and build out a new, lower unit-cost platform, conforming to a globally dominant technology roadmap. With over 85 per cent of the world's mobile subscribers using 3GPP standards such as GSM and HSPA, LTE has strong industry support from the global ecosystem.

Accesss network costs typically represent one-third of a European mobile operator's total expenditure. Although the majority of this expenditure is down to cost items such as site acquisition and power, Analysys Mason claims that base station costs still account for about 15 per cent of the total in both developing and emerging markets. The result is that network operators are increasingly investigating site and other infrastructure sharing partnerships which offer cost saving opportunities. LTE rollout could cost tier one operators another 30 per cent on today's OPEX, or as much as $8bn in CAPEX over the first three to five years. But AIRCOM believes taking the right steps at the right time could reduce CAPEX by 30 per cent and OPEX to as little as 9 -12 per cent.

Economies can also be made by adopting a multi-standard access network strategy with the implementation of infrastructure that supports LTE as well as GSM and WCDMA in the same radio unit—this is essentially a SingleRAN

deployment and is designed with a consolidated set of hardware components and an SDR system. The main benefit here is as future-proof a solution as is possible, and while the outcome may depend on what legacy the operators have, and what costs they can save, there is much to be gained in terms of saving OPEX by investing CAPEX.

Some operators are already replacing all platforms with a single one, which may cost more in the short term, but will save them a lot of OPEX in the long term. The ROI may take longer than expected, because due to a large up-front investment, but most operators are aiming to support different networks—GSM, UMTS, LTE, and even LTE-Advanced—for the foreseeable future.

HSPA+ will be sufficient in some deployment scenarios, as it offers up to 21Mbps throughput without any additional antenna infrastructure and also allows operators to control service provisioning and prioritisation, delivering Quality of Experience (QoE) and Quality of Service (QoS) guarantees. This can help to maximise return on investment.

Moreover, with the implementation of SingleRAN, new features and capabilities can be easily added to existing infrastructure without requiring major investment via remote software updates. While the use of a common radio platform for multiple markets through SDR significantly reduces operating expenditures.

This type of architecture allows the operator to continually modify the network to meet coverage and capacity demands, with base stations easily re-sited to match changing usage patterns, rather than committing to high-cost infrastructure in a set location and then hoping for a return on investment. A key secondary benefit is that SDR base stations contain fewer components than their hardware-defined counterparts, meaning lower overall cost and a smaller footprint.

The capability of an LTE network to deliver large data volumes will also make backhaul a more significant cost component but operators need to plan carefully to meet the challenge by targeting bottlenecks and deciding whether a point to multipoint approach is more effective than a simpler point to point approach.

An SDR-enabled base station is able to help out by using some of the RF spectrum to backhaul traffic from remote base stations to a centralised node, which helps an operator to save in operating costs. As for transport technology, with network operators in a transition phase, hybrid networks with 2G, 3G and even 4G infrastructure, connected by different types of transport and additional data backhaul are the norm. It may be considered an operational nightmare, which is why IP is heralded as the saving grace, but until the last 2G node is removed from the network—sometime in the distant future—there will still be a complex mix of TDM, ATM, Ethernet and IP.

The migration from TDM to packet-based Ethernet and toward a converged all-IP backhaul network is firmly established, but operators are reluctant to migrate voice traffic until they are satisfied that timing and synchronisation problems have been resolved.

Backhaul is a big issue in LTE networks, especially in the planning stages. While the radio interface is able to self update and evolve automatically, operators must ensure there is enough capacity available on the backhaul as well. Once technologies like Automatic Neighbour Relations (ANR) are implemented, the way backhaul is routed between base stations will need to be carefully considered.

OPTIMISATION & COST EFFECTIVE DEPLOYMENT

There are a number of potential pinch points in both the RAN and the core network, and traffic management techniques addressing these areas will vary accordingly. The key problem is that new technology is being rolled out on top of old, and to negate the impact of adding these new technologies, each layer needs to be optimised, using data from the existing network. Operators first need to monitor the network to understand performance issues, giving them the tools they need to reconfigure that network and make it as flexible as possible.

Much of the extra signalling traffic on the network will be created by applications which generate relatively low volumes of actual data traffic, but have a very high signalling overhead. A prime example is the trend for in-app advertising, in which the on-screen ads in many mobile games and applications are constantly updated, generating lots of signalling traffic. Although flat-IP core networks in 3GPP Release 8 (LTE) and subsequent releases are designed to reduce signalling overload, the highly complex smartphone devices available today mean a potentially serious problem in the form of congestion on the signalling channel caused by 'chatty' applications.

The industry is tackling capacity limitations using traffic-optimisation techniques such as compression. Rather than shifting the data-congestion problem to somewhere else in the network, optimisation of the data can reduce overall bandwidth usage and free up capacity. By monitoring traffic at the content layer and using adaptive-learning and data-reduction algorithms, the number of bits that have to traverse the transport layer can be reduced. The approach can be selectively applied at hot spots and areas of high traffic volumes without jeopardizing voice services, which can achieve an increase in capacity during busy periods.

Fortunately, LTE radio products incorporate several features catering to self-configuration and self-optimisation of equipment to simplify and reduce network rollout and management cost. While some self-configuring elements of SON (Self Organising Network) are already in common usage in LTE deployments today—ANR being the main one—many will only be fully adopted within the next two to three years, when the network architecture will be more able to constantly retune the entire network. Before this point, though, self healing capabilities will come into play, enabling the network to compensate when something goes wrong.

LTE SON makes use of network intelligence and management features in order to automate the configuration and optimisation of networks, lowering costs and improving network performance and flexibility. A key element is its ability to support multi-vendor network environments, reducing time-consuming and error-prone manual processes, and increasing the efficiency of the network. AIRCOM's expertise in this sector stretches to coordination of these SON algorithms, specialising in monitoring and building trust in them and ensuring coordination and eliminating conflicts.

AIRCOM'S OFFERINGS

AIRCOM's range of integrated products are designed to assist operators in planning, managing, configuring and optimising mobile networks. The company's I-VIEW framework encompasses all its products, providing a common basis for an open standards based, integrated and scalable solution.

ASSET provides a one-stop-shop for planning and optimising multi-technology radio networks. Its advanced network design capabilities save both time and money during network deployment by automating time consuming tasks such as site configuration, traffic planning, and network dimensioning.

CONNECT addresses the requirements of operators with a full range of transmission planning capabilities including mobile backhaul, access transmission, microwave and TDM/Ethernet backhaul planning. Seamless integration with ASSET enables carried traffic analysis and unified backhaul route planning to provide the ultimate integrated RF/TX platform.

I-VIEW Dimension brings together RAN and mobile core network element planning with integrated support for multi-layer transmission planning. This is done within one modelling framework providing a powerful end-to-end mobile network planning and dimensioning solution.

OPTIMA is an advanced network performance monitoring tool, developed for operators of mobile, fixed and IP networks who require an application with the ability to manage data from multi-vendor, multi-domain and multi-technology networks. OPTIMA's powerful reporting and analysis functionality enables an efficient and targeted approach to network improvement and troubleshooting.

I-VIEW Live Plan automatically keeps the data in your planning tool aligned with the live network. This allows network expansion plans and optimisation changes to be performed using the actual live network configuration to ensure maximum integrity of the design.

Consultancy Services As networks and business models evolve, so have we. By relying on AIRCOM's state-of-the-art products, technology partners and longstanding experience in consulting services, we can offer our customers turnkey managed services. AIRCOM continues to develop service offerings by combining its product strength and services experience in order to fulfil the migration to LTE and full IP networks. Additionally supporting the development of network analytics and SON multi-vendor platforms.

AIRCOM IQ combines consultancy services and the use of AIRCOM product technology to support Spectrum refarming and/or network performance optimisation. The optimisation and 3rd party tools process comprises various phases including: auditing of existing network quality and planning environment; measurement of user experience via probes and other readily available techniques; delivery and implementation of new frequency plan and parameter changes, measurement-based optimisation; detailed analysis of a range of criteria and parameters affecting performance.

AIRCOM DNA combines consultancy services and the use of AIRCOM OPTIMA product technology to provide performance management services on a full outsource mode to operators

LTE Fast Track increases the speed of deployment of LTE services and produces meaningful data for vendor selection or launch of the network. AIRCOM has already supported the some of the first LTE trials and roll outs around the world. Based on our experience we have created a solution that ensures the network is evaluated and accepted in a consistent way, minimising any possible delays. By providing clear KPIs and acceptance criteria you can be reassured your network will have a successful launch.

AIRCOM CAT Core Access transmission - A solution providing auditing, planning and optimisation services to Core and Access Transmission networks. Providing operators with cost effective ways to migrate to full IP networks suited for offering wireless broadband access

Spectrum Re-farming AIRCOM introduced its focused spectrum re-farming service to target CSP's looking to free up spectrum for growth or for re-deployment into another technology such as LTE and has seen good demand for the offering.

CONCLUSION

LTE is fast becoming the dominant mobile broadband standard and the industry is backing this throughout all levels of the technology chain, with significant momentum building in terms of deployment. Four out of five operators globally have committed to LTE and the most common reason cited for launch is to increase capacity.

As a result, the introduction of more spectrally-efficient technologies such as HSPA+ and LTE, which require fewer nodes to deliver the same network capacity and the shifts towards a flat, all-IP architecture, help to reduce data delivery costs, improving the economics of a mobile data strategy.

But at the same time it has become increasingly clear that traditional network management methods are inadequate for data volumes and network complexity bearing down upon the industry. In part, SON is an important tool for operators to improve network management and efficiency, but it does not alleviate the need for more spectrum to meet the growing mobile data demands of customers.

AIRCOM has made major progress in the areas of capacity planning, performance management, RF planning and visualisation, with a strategic architecture that provides end-to-end capabilities from one source that operators can turn to in order to help bring LTE and SON elements into operation while making the maximum use of currently available resources.

The strategy is designed to enable operators to get the most from a multi-technology plan to determine where and to what extent the available technologies—new and old—should be deployed, rearranged, redeployed or decommissioned.

With many mobile operators actively migrating to LTE, key consideration is being given to ensuring network performance is optimised throughout new systems and that legacy systems are not compromised. Performance management toolsets are critical to this delivery, ideally giving the operator a view of your entire network in a single tool and proactively highlighting network problems. Relaying information about the performance of your LTE network ensures network problems are isolated and rectified quickly.

New revenue growth opportunities are arising through innovative pricing and new business models, just as LTE becomes recognised as part of the wider solution of future connectivity. The key is putting in the groundwork and making plans now. There has never been a more critical time to look at network evolution and get the most of your current assets while preparing a transition plan to LTE.

ABOUT TELECOMS.COM

Telecoms.com is the leading provider of news and analysis for the global telecoms industry, generating over 2 million page views per year. Reporting directly from the major telecom markets around the globe - 80,000 unique monthly visitors rely on telecoms.com to keep them informed daily.

Our editorial team go beyond the daily headlines and produce in-depth features on industry leaders, technological advancements and market trends – delivering content that inspires, stimulates debate, and provides insight and understanding on the key business and technology issues facing the industry.

Email: support@telecoms.com
www.telecoms.com

ABOUT AIRCOM

AIRCOM is an independent provider of network management tools and services. Our I-VIEW framework allows mobile network operators to rapidly, efficiently and seamlessly plan, manage, configure and optimise their networks. I-VIEW enables operators to regain visibility and control of their entire network, enabling radical shifts in business dynamics to become more efficient, more agile and more profitable.

The market leader in the provision and deployment of network engineering tools, AIRCOM products are in use across 135+ countries by over half the world's mobile operators. Every day, the 20 top global operators depend upon AIRCOM's tools and consultants to improve network coverage and quality for more than 1.1 billion subscribers worldwide. Established for 15 years, we have built our reputation on creating and releasing additional value from within cellular networks.

With offices in 14 countries, we provide local and regional viewpoints and resource, as well as ensuring that our operator customers benefit from our global knowledge. By looking ahead of the market and sharing intelligence, we develop the skills and tools that network operators need to remain competitive, whatever the economic climate.

With over four million hours working on 3G networks alone, our expertise translates into direct and measurable cost savings for mobile operators. From initial consultancy through project implementation, using our staff, training yours, or sourcing expertise for you to take in-house, we are dedicated to maximising the performance of your network, and therefore your business.

www.aircominternational.com

PRODUCED BY

telecoms.com

SPONSORED BY

AIRCOM INTERNATIONAL