A **3dB consult** White Paper

Challenges and Strategies for Operators in 2017 and beyond: Reducing the Cost per Gigabyte

As mobile data usage is growing rapidly each year, and is expected to grow even more aggressively by 2020, the price per Gigabyte for the subscriber is reducing over time across all markets. Some operators in Europe are trying to keep the cost at a high level, similar to the launch of LTE, and are already receiving negative feedback from the European Commission for it. For example € 35 will get a subscriber 100 times more data in Finland compared with Hungary (source: http://europa.eu/!gd84xW). Internet (mobile data) is regarded as a human right and should be available at an affordable price to everybody.

At the same time, it is increasingly challenging for operators to find monetization schemes for their LTE networks that are in correlation with traffic growth and price drops in one formula. Their own cost of Gigabyte is not decreasing at the same pace as the price per Gigabyte for their subscribers.

Introduction

Common logic is that the higher the sales volume the lower the actual cost per unit. Unfortunately, this isn't entirely valid in telecoms because of the following, but not limited to, reasons:

- Higher mobile data volumes call for more complexity in the networks
- More concurrent users means more traffic means higher interference means lower throughput
- Most Central and Western Europe countries have vast copper networks installed only in the last 10 years – this infrastructure was more than enough for WCDMA, but is outdated for LTE and hasn't made a break even yet
- Expectations for mobile data speeds are growing at a similar pace with traffic growth – subscribers want more data, they want it faster and cheaper

Bearing all the above in mind operators are under tremendous pressure by their boards and investors to keep the profitability and to maintain their 'standard' EBITDA values.

This paper aims to investigate and recommend options for MNO's (Mobile Network Operator) to **meet the expectations of both customers and investors in the current situation**. The paper will not go into deep technical details, but its intent is to provide ideas and options to MNO's mid to CxO level management

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Evolving to Network 3.0: MNO Challenges Up to 2020

Network 3.0 is all about enhancing the customer experience, improving time to market, and reducing the cost to deliver services.

Following are some extracts from the European Commission 'Europe's Digital Progress Report 2016'

- Total telecom services revenues have declined by 10 % in Europe since 2012. EU telecom CAPEX has slightly increased in the same period.
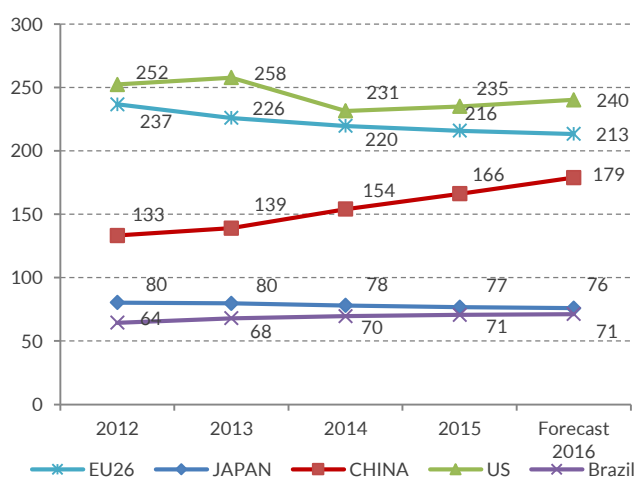

Figure 1: Telecom services revenues 2012-2016 (Europe's Digital Progress Report 2016)

- Mobile voice and fixed voice revenues have decreased by over 25 % since 2012. Mobile data grew by 10 %, and will represent over a quarter of total telecom revenues at EU level in 2016 (forecast).

  o By contrast, the growth in mobile data services (9.9 % between 2012 and 2016) is remarkable. Mobile data will represent over one quarter of total market revenue (26 %) in 2016. The growth in mobile data services could not, however, compensate for the major decline in voice.

Revenue growth rates 2012-2016	
Telecom carrier services	-10.0 %
Business data services	-0.8 %
Fixed voice telephony	-17.2 %
Internet access and services	13.1 %
Mobile data services	9.9 %
Mobile voice telephony	-30.8 %

Figure 2: Revenue growth rates 2012-2016 (Europe's Digital Progress Report 2016)

- Mobile broadband traffic: Tablets are expected to be the touchstone for mobile data traffic in 2020, exceeding smartphones and laptops in average usage. Mobile data traffic in 2020 is expected to be six times higher than in 2015.

  o Mobile data traffic in Western Europe is expected to grow by six-fold from 2015 until 2020, which represents a higher growth compared to the US (x6), South Korea (x5) and Japan (x4). Indeed, mobile data traffic will grow two times faster than fixed IP traffic from 2015 to 2020.

  o The average smartphone user in Western Europe will generate 4.6 GB of mobile data traffic per month in 2020, up by 353 % from 2015. Laptop users will generate 4.4 GB and tablet users more than 6 GB.

- Machine-to-machine communications: In Western Europe, M2M modules currently generate 3 % of total mobile data traffic. By 2020, this figure will go up to 11.6 %, while M2M modules will represent more than half of the total connected mobile devices in Western Europe.

  o M2M communications on mobile networks will continue to increase rapidly both in terms of traffic and the number of devices. M2M currently represents 19 % of all connected mobile devices. This ratio is forecasted to go up to 51 % by 2020 in Western Europe. M2M traffic will also expand, but will still take a relatively low share of total traffic on mobile networks (12 %).

  o The US and Japan will show similar figures, while in South Korea both traffic and the number of M2M devices will be significantly higher proportionally.

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- EU Cost Reduction Directive (Directive 2014/61/EU). Since the major source of costs in network deployment is civil engineering costs (accounting for up to 80 % of the total costs), Directive 2014/61/EU includes measures to reduce the cost of deploying high-speed electronic communication networks. The Directive includes measures:

  1. facilitating access to physical infrastructures of all network operators (i.e. telecom operators, as well as energy, or other utilities);
  2. improving coordination of civil engineering works;
  3. providing transparency of permit granting procedures; and
  4. equipping and accessing buildings with in-house physical infrastructure (e.g. mini-ducts) capable of hosting high-speed networks.

- Since the adoption of the digital agenda for Europe (DAE) 2020 targets — i.e. *coverage of 30 Mbps download for all Europeans and take-up of 100 Mbps subscriptions for at least 50 % of European households* — most Member States have gradually adopted national broadband plans (NBPs).

Content is King

More and more telcos are teaming up with or purchasing content providers to offer their customers more content – it can be music, films, games, mobile payments, etc. Integrating media is also an opportunity to broaden operators' relationship with its customers beyond the traditional role as a network provider. The idea is to evolve from a just an air time or pipe seller to an extended value service partner.

Options to Reduce Network Cost?

SDN, Software Defined Network

Classical (legacy) mobile networks suffer from inflexible and expensive equipment, complex control-plane protocols, and vendor-specific configuration interfaces. Software defined networking (SDN) can simplify network management, while enabling new services. Cellular data (LTE) networks are ripe for the introduction of Software Defined Networking (SDN), where the network equipment performs basic packet-processing functions at the behest of applications running on a logically-centralized controller. Software defined networking can make cellular networks much simpler and easier to manage, introduce new services, and inter-operate with other wireless network technologies and other operator networks. All this will result in savings in Capital and Operational Expenditure.

NFV, Network Function Virtualization

Network Functions Virtualization (NFV) was proposed to improve the flexibility of network service provisioning and to reduce the time to market (TTM) of new services. By leveraging virtualization technologies and commercial off-the-shelf hardware, such as general purpose servers, storage and switches, NFV decouples the software implementation of network functions from the underlying hardware. Still an emerging technology, NFV brings several challenges to network operators, such as the guarantee of network performance for virtual appliances, their dynamic migration, and their efficient placement. NFV, along with cloud computing and SDN, will become a critical enabling technology to radically revolutionize the way network operators architect and monetize their infrastructure. NFV is prospectively the unifying revolution among the three, offering more revenue opportunities in the services value chain.

Infrastructure Sharing

Sharing site locations is increasingly easy with new HW requiring less floor space, power and cooling capacity.

Sharing DAS solutions is an easy and cost-effective way of providing excellent indoor coverage in large office buildings and shopping centres. Cost efficiency is most remarkable in case of new builds or during major renovation works whereas most existing buildings would require noticeable investment for construction. In case of the latter, distributed pico solutions may prove a more viable solution, but a business case for shared DAS solutions shouldn't be discarded.

In case of already shared site location: share optical fibre for MBH, combine/coordinate civil works and site visits.

MOCN, Multi Operator Core Network

In this approach the base station hardware is shared and is broadcasting more than one Mobile Country Code (MCC) and Mobile Network Code (MNC) in the System Information of a radio channel. In case of UMTS this is done in the Master Information Block (MIB) while in LTE it is done in the System Information Block (SIB) 1.

In scope of MOCN both/all operators' radio frequencies can be combined to be used on every site meaning that carriers with largest bandwidth are available for the subscribers.

MORAN, Multi Operator Radio Access Network

If each of the network operators sharing a base station uses his own spectrum (i.e. his own radio channel) the operators share the backhaul link from the base station to the core network and the digital module of the base station but have separate RF paths and radio units. A simple mobile device trace analysis can't reveal if the two signals come from the same base station or not. One would have to compare the network configuration parameters in the system information messages carefully but even here there might be differences.

Small/Pico Cells

Small cells and pico nodes can be a cost-effective way of providing coverage or capacity or both in small hotspot areas. While these provide coverage in limited areas operators must ensure seamless handover to and from the small cells to guarantee a good user experience. Small cells provide a good alternative to stand alone base stations which in many cases would be an overkill of coverage, power and capacity and to repeaters that can only deliver coverage, but will not add any capacity and are often complicated to manage.

In fact, there are several vendors that are offering specialized equipment for indoor and outdoor Small Cell solutions such as dense urban areas, office buildings, shopping centres or sport stadiums, which make possible to unify the UMTS/LTE and WIFI data in an access point.

In addition to the first objective of fixing the coverage holes, the incorporation of these purposeful designs allows the technology to blend effortlessly into its environment,

giving immediate and flexible solutions with a simplified installation process. This flexibility, makes them appropriate also to be used in areas in which there is an increasing substantial demand of the network providing immediate network capacity expansion and minimized network impact.

Transport network evolution to all-IP

IP transmission (carrier ethernet) enables operators to deploy 'flatter' networks with less network elements and fewer points of failure. At the same time management systems must handle hybrid circuit/packet networks for many years to come to support all the CS traffic that is still a major component in the complex three technology networks.

An all-IP transmission solution is most relevant, because:

1. It can handle legacy 2G and 3G voice traffic by applying PS/CS conversion
2. It can handle latency requirements for LTE
3. It can handle capacity requirements for LTE
4. It can handle security requirements for LTE
5. Capacity upgrades and topology changes can be performed remotely and are cost effective
6. It can handle 2G, WCDMA and LTE on the same backhaul network

Options to Reduce Network Cost AND improve customer experience?

Effective Network Planning and Dimensioning

A correct network planning and dimensioning is indispensable to ensure that enough resources are available on site to handle data traffic growth. This may be done by analysing the current situation of the network and bearing in mind future requirements. This analysis will show the needs regarding sites deployment, new cells deployment or capacity increases

Doing this in the correct way will allow the operator to plan and perform all the actions on sites together and just in the moment they are needed. If this task is not carried out as proposed visits to sites will have to be planned one by one increasing costs and capacity increases will be not done on

time but in a reactive way causing bad user experience and loss of traffic which could even lead to lose clients.

Effective Network Optimization

Optimization of the current network to facilitate growing data traffic needs with reasonable quality. Avoid unnecessary interference that will cause retransmissions, BER, more robust modulation usage and eventually lower throughput.

Special challenges in multivendor scenarios, especially in vendor border areas. Competent and experienced team is needed using functional multivendor tools.

Some operators insist on doing everything on their own, because they know all details of their network, but it can be more time and cost effective to outsource the tasks to an experienced partner to avoid delay in improving/optimizing the network.

Effective Events' Management

Network performance in massive events is nowadays an issue in which MNOs are usually focused on. In fact, the performance of the network in these events can change the perception that users have of the operators' quality of service and also can affect network overall performance as data traffic in those events is growing day by day.

It is essential to take a proactive approach to plan and manage events: add capacity, change parameterization to avoid/minimize ping pong, congestion, interference etc. This will result in higher throughput and higher customer satisfaction.

Event Real Time Performance Monitoring (RTPM) is a service which provides the way to detect as fast as possible any degradation and allows acting in a fast way reaching great results in network performance and user experience in massive events which will avoid losing clients.

Leaving the management of this activity to an external partner will reduce costs for MNO as the will not have to waste time in the preparation, monitoring and fallback of the event.

Effective Degradation Monitoring and Detection

There are several ways to offer a degradation monitoring and detection service, which if focuses on constantly monitoring not only alarms, but also degradations / deviations from normal performance. For example, two ways to do so is by a daily basis service or a RTPM service which continuously monitors the network performance.

Any of them, which could even be complementary services, is really helpful to solve network degradations as soon as possible and this offers a better user experience, ensures most efficient resource utilization and avoids losing calls, connection or even clients.

Externalization of this activity will reduce costs for MNO as an external partner with help of tools is an efficient and effective way to avoid wasting time and resources.
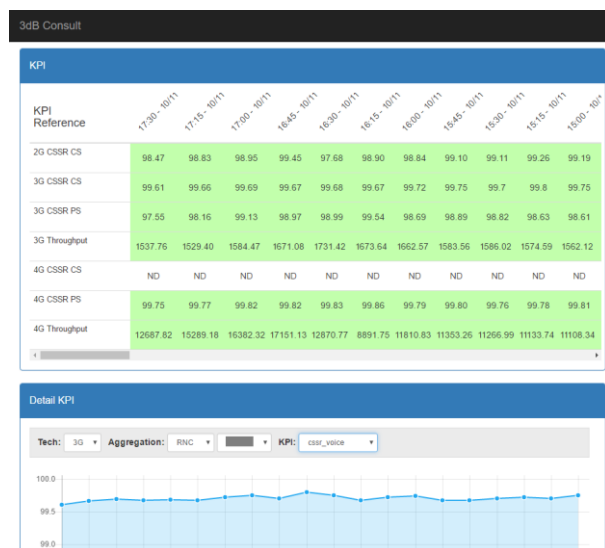

Figure 3: KPI and degradation monitoring www.3dbconsult.com

Effective Worst Cell Analysis

This task involves analysing regularly the worst behaving cells / sites and improve them by optimizing the offending site or neighbouring sites that may cause the problems. It is important this task to be performed on regular basis, because cities evolve, people move and traffic hotspots move with them.

Worst cell analysis is one of the most effective way to improve mobile networks' performance as by analysing and

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taking measures over cells or sites that are those which are most degraded and carry most traffic, network KPIs and user experience improve considerably.

Radio network accounts for about 80% of mobile network operator energy consumption and this supposes the 15-25% of network OPEX.
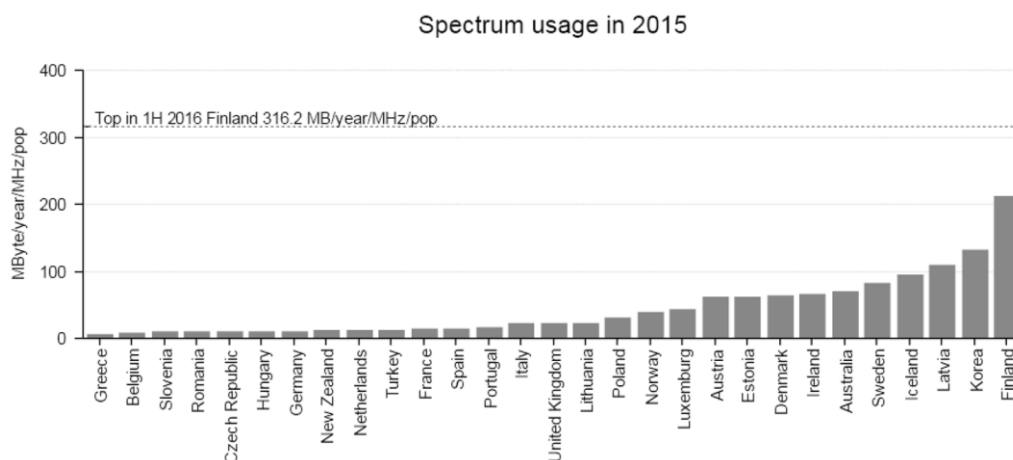

Figure 4: Spectrum usage efficiency acrosss Europe in 2015, (Source: http://dfmonitor.eu/)

It is key to define an effective procedure, an effective methodology which will show those cells which have the biggest impact in networks' performance. In the same way the usage of tools is also essential to get real gain of this task which will offer better user experience and will make users stay in the operator.

By deploying energy saving features in the network, costs can be reduced in a considerable way without compromising the quality of service for the end users.

Activities such as activating energy saving at node or carrier level, MIMO sleep mode features or carrier/cell shut down features, will help operators to reduce costs.

Wise New Features Implementation

Mobile networks and user behaviour / requirements change. Due to this, vendors work in launching new features to enhance network performance and many of them can lead to achieve great improvements in KPIs and user experience.

It is really important to always consider testing / implementing new features that improve the network efficiency. External support choosing different environments for the tests, preparing network configurations and getting the final results is usually the most efficient and successful way to perform this task.

Measure the Right Things

Classical KPI's are not enough for a data driven network although they still remain relevant. Operators need to put more focus on measuring customer experience, but at the same time they have to avoid over dimensioning of the network to keep own cost of Gigabyte down. In this context it would be wise to measure the efficiency of the network and a good indicator for mobile data networks is spectrum usage: MByte/year/MHz/pop.

Really Energy Saving Features Activation

In mobile networks, the access network and, in particular, the RBS is the largest consumer of energy, and this is where most energy efficiency improvements must be focused.

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Summary

Mobile network operators are under increasing pressure to deliver more whilst charging less. In classical MNO mode of operation, this means win-win will be extremely difficult, if not possible, to achieve. It is inevitable that operators will have to rethink their operations – to virtualize functions, gradually shift from bespoke hardware to software defined networks, find synergies in infrastructure and RAN hardware sharing.

In parallel, it is paramount to address network performance challenges to ensure efficient usage of the radio network resources while delivering the highest possible quality to subscribers. These activities are not dependent on the RAN or Core hardware, can be executed before or in parallel with the activities above. They include:

- revising current planning strategies
- constant and efficient RAN optimization
- daily analysis and improvement of worst cells
- professional and proactive handling of big events

References

1. http://europa.eu/
2. http://dfmonitor.eu/
3. https://www.cs.princeton.edu/~jrex/papers/ewsdn12.pdf
4. http://web2-clone.research.att.com/export/sites/att_labs/techdocs/TD_101400.pdf
5. http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=15807

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3db consult is a Telecommunications Engineering and Consultancy Company with extensive knowledge and experience on Mobile Networks Design, Managing and Optimization.

In the market since 2004, for more than 12 years we have had the opportunity to work in some of the most interesting and demanding MNO projects in Europe, where we have always excelled in Quality and Reliability. Thanks to our team of Engineers, the intensive training programs they undertake and our self-produced sets of tools, we do provide for serious Network Solutions, both in Consultancy and Engineering formats.

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