LTE – The Bigger Picture

Northstream White Paper

June 2010

LTE: One Year Down the Road

About a year ago, Northstream published its first white paper on the topic of Long Term Evolution, or LTE – 3GPP's project defining a high-performance, cellular air interface and often referred to as "4G". Our first study elaborated on the various reasons why we believed that industry expectations on the amount of early commercial launches were overly optimistic, as well as our view on the conditions that should be fulfilled before operators launch LTE-based services.

How do we view last year's recommendations today? We have updated our analysis based on the developments in the mobile broadband market during the last fourteen months, and we have revisited the reasoning for operators to embrace LTE as part of their service and technology strategies.

The First Commercial LTE Service

As of today, TeliaSonera is the world's only operator offering a commercial LTE service. The service is available in two Nordic capitals; Oslo and Stockholm. Users receive a package with two modems; a USB stick from Samsung providing LTE access, and an HSPA modem for usage outside these two cities. With promoted and proven downlink speeds of up to 80 Mbit/s, the LTE service is up to 8 times faster than the operator's HSPA offering.

Compared to its fastest HSPA service, Telia Sweden charges a premium of 85% or higher for the LTE service; depending on the package and subject to campaigns. As other mobile broadband tariffs promoted by Telia, "4G" also comes with additional features and bundled services; some of which are provided as part of a promotional campaign. Figure 1 gives an overview of the service package.

Highlights of Telia Sweden's "4G" mobile broadband service:
- 599 SEK/63 € per month (outside of promotion)
- Max. speed 80 Mbit/s on LTE, 10 Mbit/s on HSPA (separate modem)
- 30 GB monthly data allowance
- Free security software and file backup
- Free access to 3,300 WLAN hot spots

Six-month summer campaign:
- Monthly fee reduced to 359 SEK/37€
- "Sommarfilm"; unlimited access to a library of 50 films
- Free extra 5 GB / month (else 119 SEK/12 €)

Sources: Samsung, Telia. Offering and prices as of June 2010

Figure 1: Summary of LTE Service Offered by TeliaSonera Sweden

Real-Life LTE Service Experience

Since the commercial LTE launch in December 2009, a number of end user and test reports have appeared, with Northstream being one of the early users. We performed our first LTE tests in January 2010 and repeated the test in June, leading to the following main observations:

- Speeds are delivering on the promises, although radio strength and service performance are very sensitive to small changes in location
- LTE offers far shorter response times: On average we measured 32 ms which compares to a range of 40 – 150 ms observed on HSPA networks in Sweden
- Our first test in January showed some "teething issues" of the LTE service, such as dropped connections or difficulties to connect at first attempt. As of June 2010, the service appears much more stable and reliable.

Figure 2 summarizes the results of Northstream's latest field trial.

LTE	Downlink / Mbit/s	Uplink / Mbit/s	Response time / ms
Min.	1.7	2.6	21
Max.	65.3	4.8	155
Average	30.2	4.6	32
Median	27.1	4.7	26

Source: Northstream

Figure 2: Results of Northstream's LTE test, June 2010

Our tests carried out in Stockholm are quite encouraging – they confirm that LTE can deliver performance that is far superior to HSPA. The downside is that the service experience varies significantly within the small metropolitan coverage area. Furthermore, the absence of laptops with embedded LTE makes users reliant on external USB modems, with an additional HSPA modem required until multi-mode equipment is available.

The desire to compare the performance of LTE and HSPA is obvious, but such comparisons must be done with caution. Today's HSPA networks operate under high load and users are unlikely to experience the maximum theoretical speeds. On the other hand, the number of LTE users is still small, meaning that early adopters of TeliaSonera's service likely only share the network capacity with few other users. Due to their early stage, LTE-based services cannot yet be seen to have mass consumer appeal.

This, however, does not limit operator efforts to experiment with new connectivity technologies at an early stage and enter the mass market once certain prerequisites are met – a strategy recommended in last year's LTE white paper. Wireless data is the core business of a mobile operator, and market conditions require constant improvements of performance, user experience and cost base. Rather than spending too much time analyzing early LTE services in a standalone fashion, Northstream believes that the technology should be viewed in a wider context of network evolution and operator service strategy.

LTE in a Wider Context

The latter aspect can be discussed based on Telia's launch. As shown in Figure 1, the operator has bundled the LTE plan with a couple of additional features including security software and media streaming. This is an effort to build value on top of the access service in an ambition to provide users with the best possible internet experience and justify the premium compared to HSPA.

While such additional features are important, they should not distract operators from their core business and understanding how LTE fits into the bigger picture. Generally speaking, operators do not possess the working culture and skills required to be service innovators or even full-service providers of digital services and content: The level and speed of innovation originating from online service providers (OSPs) is too massive for operators to offer serious competition on the service level, even in markets where operators continue to dominate mobile service delivery.

Therefore, the question is not which applications LTE can enable: Digital service providers and consumers will respond once networks and terminals are widely available and affordable. Once these and other prerequisites are fulfilled and customer demand emerges, operators can stimulate demand and monetize it by partnering with OSPs and promoting services through their widespread sales channels.

Rather than services and applications, the question is how LTE can help operators with one of their prime challenges: addressing margin issues and lowering the cost of delivering mobile services. Profit margins have been under pressure the past ten years, requiring constant cost improvements. In parallel, voice and data usage has increased substantially. LTE and SAE (System Architecture Evolution, the standard for the underlying All-IP core network) are technologies that operators must take into account in order to achieve a cost base low enough for a profitable mobile broadband service.

Mobile Broadband: Cost Efficiency is King

In addition to the **RAN** we would like to highlight further cost aspects that relate to mobile broadband.

The first being the **core network**: In addition to the SAE aspect referred to above, user data consolidation and IMS enablers are can support cost efficient service delivery. User data consolidation – at least for HLR and HSS – helps lowering capex and opex for activating and managing subscribers, enabling operators to launch lower-priced plans for connected devices. Furthermore, IMS-based rich communication services can generate sales, even if the market potential is still to be proven.

Secondly, evolving the legacy **backhaul networks** from an E1/T1-based regime to an Ethernet/IP based architecture is critical in order to reach a better price-performance ratio (scalable throughput at lower cost per MB). New types of connected devices and OSP-driven services lead to continued growth of downstream and upstream traffic emphasizing the need to build the network with inherent scalability.

Meeting such requirements, fiber is one of the best solutions from a performance viewpoint combining superior performance with the possibility to step by step scale the capacity. With increased competition on the backhaul market, and falling prices of fiber equipment, both self provided and leased dark fiber is now extending beyond the core backbones and deep into the access networks. Combinations of fiber and microwave Ethernet provide operators with cost-efficient options to enable scalable transmission networks.

Thirdly, the **site infrastructure** cost is an important area to consider. This item covers towers, masts and civil works; i.e. site elements not directly related to radio equipment. Looking at the total site capex, the importance of site infrastructure has increased: According to Northstream calculations, site infrastructure accounted for 60% of site capex in 2005. This figure will grow to 75% in 2010. This increase is a consequence of the lower prices of radio equipment which have made costs for towers, housing, heating and cooling or feeders a more important cost contributor.

Keeping site infrastructure costs under control is key for those operators that still need to erect new sites; mainly for LTE coverage when there is no sufficient density of existing 2G or 3G sites at available spectrum bands. Other operators will focus on the site opex, such as energy costs or the reduction of maintenance costs.

Figure 3 summarizes the above-discussed cost efficiency measures as part of a mobile broadband cost check list.

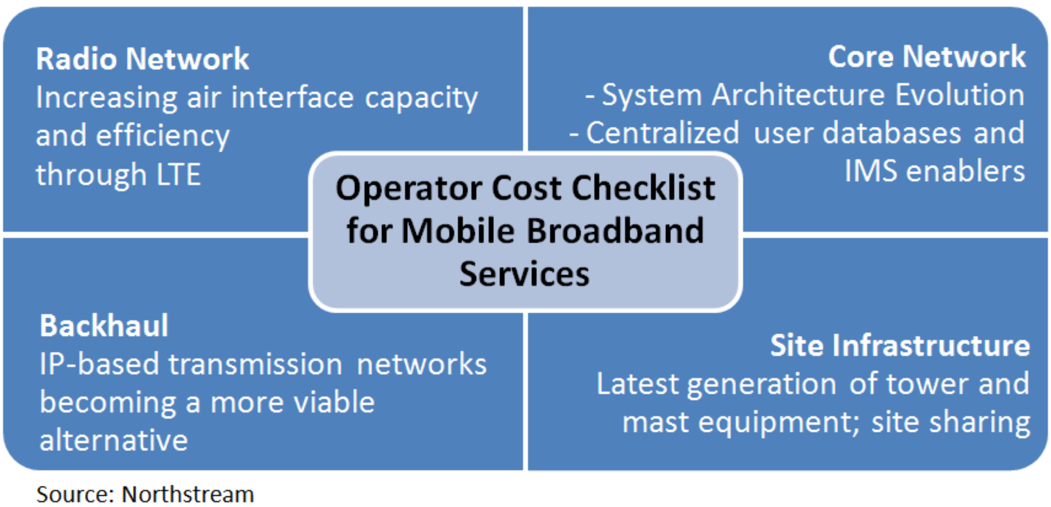

Figure 3: Operator Mobile Broadband Cost Check List

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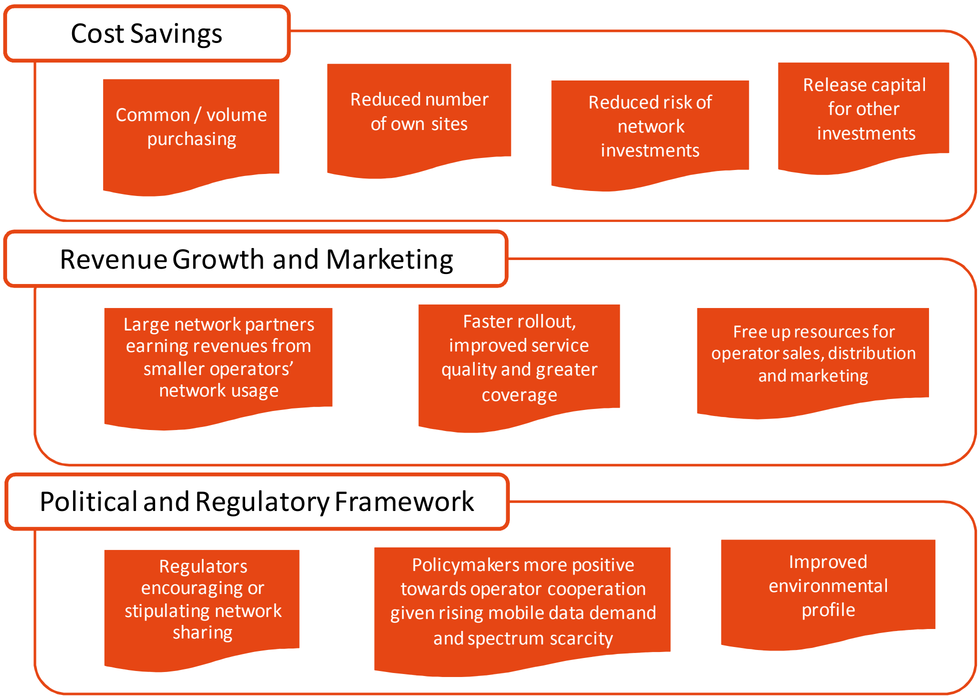
Renewed Interest in Network Sharing

Network sharing is a topic that has re-appeared on the agenda of many mobile operators, mainly due to the above-mentioned need to provide high-quality network coverage and capacity at lower cost. However, other aspects such as faster rollouts, regulatory requirements or better availability of vendor solutions improve the network sharing case.

As discussed in Northstream's last LTE white paper, HSPA still holds major potential for capacity and speed improvements and will remain the key mobile broadband technology for many years to come. Depending on the license situation in each country, operators now have the opportunity to consider their LTE network sharing approach as part of their overall technology and commercial strategy. In Northstream's view, only the largest operators in a country will be able to add and profitably operate LTE networks on their own – but even in such cases, sharing brings benefits not only on the cost side.

Figure 4 summarizes common motives for operators to enter passive and active network sharing agreements. These reasons apply for 2G/3G networks alike, but LTE amplifies the rationale. More capacity will lead to more traffic and operators need to ensure that LTE's promise of more efficient capacity is turned into tangible cost savings. Better availability and higher maturity of infrastructure solutions for network sharing may in fact improve the case compared to early 3G sharing agreements.



Source: Northstream

Figure 4: The Operator Rationale behind Network Sharing

Further Items on the LTE Checklist

Northstream sees further aspects that operators should keep in mind when it comes to the strategic positioning and profitability of LTE as an internet access technology:

- **Voice strategy:** Since the GSM Association's announcement of the VoLTE initiative in February 2010, it appears clear that the telecoms industry has agreed on using IMS and MMTel (Multimedia Telephony) as a standard for voice over LTE. The technology choice is made, but it only affects LTE: GSM and UMTS networks will continue carrying the bulk of voice traffic during any mobile operator's planning horizon.

  Sooner or later, operators must decide whether to invest into voice, or whether to slowly exit the voice segment as GSM networks approach their end of life. Some operators may conclude that LTE voice revenues do not justify the related costs and uncertainties: Cost for service platforms, RCS solutions, device software, subsidies, customer service, as well as risks concerning battery life, handover and user experience will be main challenges.

The trend towards rich online communication adds to the issue: Online service providers such as Skype, Google and Facebook will enter the voice market or have already done so, providing a user experience that includes contact management, presence, messaging and video calling. This raises the bar for operators to deliver a service that today's mobile voice is just a small part of.

- **Connected devices:** The mobile industry has high expectations on the growth of so-called "connected devices": industrial appliances, consumer electronics or other products being equipped with cellular internet connectivity. Some forecasts aim as high as 50bn devices by 2020, suggesting exponential growth of mobile broadband connections. Irrespective of the accurateness of such forecasts, it is clear that operators need a strategy of how to act in this growing segment.

  Operators should consider the interests of the device vendors and the connectivity needs of the applications they support. Most devices do not require high bandwidth, and price sensitivity is high. During the next few years, we believe that only selected high-end media-centric devices will come with embedded LTE, with the majority of connected devices relying on HSPA or even GPRS connectivity.

  In the long term, LTE can play out its advantage of being the only high-speed mobility standard that is globally accepted, providing device vendors with scale effects. The potential of free connectivity in unlicensed bands is another potential aspect to consider, albeit not necessarily welcome by operators.

- **No standalone business case:** As discussed in this paper, operators should regard LTE as a continuation of their radio technology evolution, rather than a standalone network or a new service. With the right sales and marketing approach, operators can upsell consumers and B2B partners to more efficient LTE connectivity, with HSPA providing the bulk of data traffic and geographical coverage. Topics raised in this paper such as backhaul, IMS core network, multi-mode devices or new competition in consumer services are just examples showing that LTE should be seen as part of a bigger picture.

Northstream – Strategy and Sourcing

Founded in 1998, Northstream is an experienced management consulting firm providing strategic business and technology advice to the global telecom and media industries. We help our clients through independent and objective analyses, advice, problem-solving and support that are tailor-made to our client's situation. Our work is based on a well-balanced combination of innovation, industry best practices and in-house methodologies. Northstream typically works with:

- Business strategy development and planning
- Strategic sourcing of systems and services
- Technology & product strategy evaluation
- Operational review, optimization and support
- Investment analysis and due diligences

Clients across the world include mobile operators, network and device suppliers, application providers, investment banks, regulators and industry fora. Contact us to learn more about how we can work together to ensure your success in the mobile voice and broadband business.