LTE take-up in Baltic States and the European context: urban first

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Abstract: Deployment of the 4G mobile broadband expands starting from urban areas. Experience of Baltic States NRAs would be instructive for other small and medium-size countries too.

Rapid increase of mobile broadband (MoB) communications take-up is a characteristic feature of the last decade. Total number of active mobile subscriptions in the world during the last 10 years has increased by more than 6 times and has reached 6 billion; while 20% of them are broadband subscriptions (ITU 2012). The same trend is followed in the Baltic (Estonia, Latvia, Lithuania) mobile markets where the number of mobile subscriptions has increased by 6,5 times.

Long Term Evolution (LTE) is appreciated for its ability to satisfy rapidly growing demand. Following global pioneers, TeliaSonera's subsidiaries in the Baltics launched commercial LTE services in major urban areas using a 1800 MHz band:

- Estonian operator EMT in December 2010 (download speed up to 100 Mbps, monthly data cap 30 GB with a tariff that currently represents 3,8% of average personal monthly income);
- Lithuanian Omnitel in April 2011 (80 Mbps, monthly data cap 10 GB for 4,6% of monthly income);
- Latvian LMT in May, 2011 (100 Mbps, no data cap for 4,1% of monthly income).

Although LTE consumers' take-up in Baltics is quite low yet, several other operators have started provision of LTE services.

Regularities, individualities and projections of the three Baltic MoB markets (in the context of global most developed leaders) can be indicative for small and medium-size countries not only in the Europe. The problem is lack of exact comparable statistical data on MoB markets due to nonbeing of internationally approved methodologies. For this purpose we will try to be conservative respect our conclusions.

Mobile broadband demand – driving and disincentive factors

Major MoB demand drivers as reported in UMTS (2011) are also relevant for the Baltic countries. Nevertheless some peculiarities have to be mentioned.

The spreading of broadband devices (smartphones, media tablets, dongles, M2M (machine-to-machine) devices, etc.) and of the associated services is the most significant factor nowadays; e.g., Latvian operator LMT has announced more then 50% growth of M2M applications for business customers in 2011.

The impact of mobile communications at a macroeconomic level is a source of direct motivation for government to support broadband rollout; the annual contribution to growth of GDP until

2007 was evaluated by Gruber (2011) for the Baltic countries too: Estonia – 0,376%, Latvia – 0,290%, Lithuania – 0,333%. There is found some correlation among MoB penetration and GDP per capita (PPP) in EU Member States. Another conclusion is that municipalities are interested to support deployment of MoB that will be suitable for implementation of their functions – smart transport management, utilities services, public safety, etc.

A peculiar but very catalytic forecasting criterion is the combined market performance indicator of mobile and internet services (DG 2011) that shows consumers' assessment of the MoB market and their satisfaction with the services provided, their quality, availability, reliability, security, cost, etc. Higher assessment means the motivation for more intensive take-up and usage of MoB and therefore more dynamic growth and sustainability in the future. An informative general tendency is reduction of market performance indicator when penetration increases (fig. 1). Apparently overloaded mobile networks cannot meet high demand. And exactly Nordic countries, which are global penetration leaders, are pioneers of the LTE deployment too.

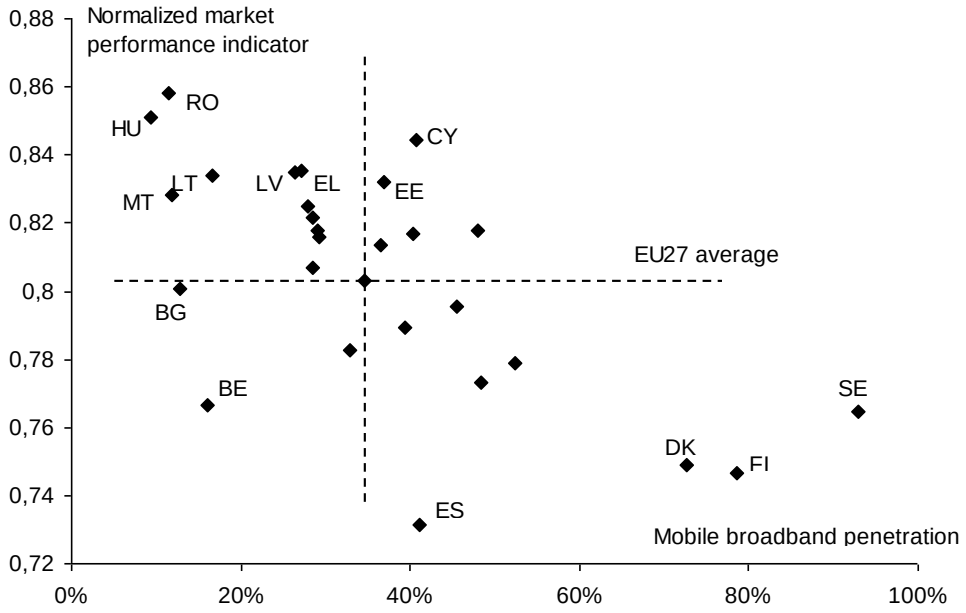

Fig. 1. Combined (mobile and Internet services) normalized market performance indicator vs. mobile broadband penetration; EU countries, June, 2011.

One can find high relative scores of Baltic markets at EU level that confirm current quality and accessibility of services at affordable prices; e.g., using HSPA technologies real download speed in many regions of Latvia and Lithuania has exceeded 4-6 Mbps in 2011 (Estonian National Regulatory Authority (NRA) does not perform quality measurements currently). It makes implementation of growth forecasts more optimistic.

Prognosis of demand

Two basic criteria characterize demand of mobile services – penetration and traffic. A number of quantitative adoption models, expressed mathematically in the form of more or less sophisticated functions, (e.g., linear, exponential, modified-exponential, logistic, Gompertz or the general Bass model) can be used for prognostication of both criteria. The S-curve

(sigmoid) model based on the Gompertz function, which can be appropriately parameterized, was chosen as it provides sufficient flexibility for predicting various penetration and traffic growth scenarios. Finally, different proposed forecast frameworks are analyzed in the generic setting of a dense populated urban network deployment scenario.

Penetration of subscriptions is the most popular indicator. Europe is a global leader in MoB deployment; active MoB penetration in Europe exceeds America's indicator by 80% (two-year lag!) and is threefold the global figure (ITU 2012). Total mobile penetration in Lithuania (147%) and Latvia (136%) is among the highest in EU27, while the Estonian figure (120%) is very near to EU27 average level (124%). MoB penetration figures are opposite – Estonian level (36,9%) is slightly upper than EU27 average figure (34,6%) while Latvian (26,3%) and Lithuanian (16,6%) parameters are lower (EC 2011).

The MoB rollout would be seriously hindered by parallel development of fibre access-availability of very high quality fixed broadband in Lithuania and, especially, in Latvia (see, e.g., Akamai 2012) and implementation of national-wide middle mail optical network projects ongoing in Estonia and Lithuania as well intended for Latvia.

A negative peculiarity of the Baltics is the high level of emigration of young people (especially in Latvia and Lithuania) due to ongoing economic problems. It reduces the demand for advanced applications as the young generation is the most active traffic creator.

Over the next years traditional mobile penetration growth will decelerate, but due to new M2M applications a penetration level of around 170% is expected in Western Europe (WE) in 2020 (UMTS 2011); the above figures show that the same level can be predicted for the Baltics. Growth of MoB penetration in Baltic States will be more rapid due to gradually growing purchasing capacity and development of local content that is underdeveloped nowadays. Estonia and Latvia have already arrived at the most dynamic part of the development S-curve. Lithuania is very near with MoB penetration expected to reach 60-65% in 2020.

Generated mobile traffic volume per subscription is another demand indicator in WE it was estimated to be 300MB per month in 2010 (Analysys 2011). There is lack of exact statistical data on traffic in Baltics; nevertheless evaluation of fragmented (even incompatible) data provides a ratiocination on comparatively similar average traffic figures in all Baltic States that were around 80MB in 2010; i.e. the Baltic States are lagging about three years behind WE.

The trend of traffic growth typically complies with the regularities of the S-curve. The current level shows that we are in the initial phase still, but the growth stage is not so far. Furthermore, experts predict that mobile traffic growth in Central and Eastern European regions will be slightly faster in comparison with WE in the middle term (see, e.g., Cisco 2012, UMTS 2011). We expect reduction of the existing gap till one year in 2020, i.e. around 5GB per subscription in Baltics (in comparison with 6 GB in WE).

Development of supply – urban LTE

Mobile operators have quite equal portions of basic GSM and UMTS mobile communications frequency bands nowadays to deliver MoB flexibly in all Baltic States. The problem for Estonia (and partly for Lithuania) is fragmentation of the allocated bands. A strategy of Latvian NRA was to launch unified spectrum portions.

Nevertheless, the projections indicate that after 3-5 years, currently used spectrum bands will not be able to satisfy growing MoB traffic demand. In addition it has to be mentioned that new demand is normally created (and increases over the time) when access to the network is provided. Therefore NRAs of Baltic States have auctioned new spectrum licences for LTE services.

To return their investments operators are interested in the first place to cover areas with higher potential traffic, i.e., with larger amount of solvent consumers. Several hundreds of permanent residents (plus non-residents arriving on job, studies, tourism, etc.) per cell site would ensure profitable exploitation of the LTE network.

In general, population density is low in the Baltic States (Estonia – 31 pop. per km^2, Latvia – 34,5 pop. per km^2, Lithuania – 49 pop. per km^2), while the urbanization level is near EU27 average (Estonia – 69%, Latvia – 68%, Lithuania – 67%); nevertheless a significant share of urban population lives in small sparsely populated settlements.

Gross income of urban household member exceeds that of rural resident generally by 10-35%; larger amount of solvent consumers really is concentrated in highly populated major and medium-size cities. Cost/revenue models show business advantages of urban areas even in comparison with main roads (see, e.g., Velez F. J. and Correia 2002).

Therefore, cities with more than 10 000 residents and density higher than 1000 pop. per km^2 are the priority for LTE network deployment in the Baltics. They include:

- 11 cities in Estonia (in total 56% of Estonia's population);
- 17 cities in Latvia (in total 56% of Latvia's population);
- 23 cities in Lithuania (in total 53% of Lithuania's population).

It shows purposefulness of auctioning 2,6 GHz band in the first place. There is also another reason that is common for all Baltic States – usage of 800 MHz band (that is preferable in rural sparsely populated areas) currently is inconvenient (especially in 10-15 km border zone) due to usage of these frequencies for Radio Navigation Services in Russia and Byelorussia until 2015. Hopefully migration of RNS systems from this spectrum will take place, because it is estimated to have a benefit of EUR 19 billion for Russia for the period 2015 to 2030 (Analysys 2010).

2,6 GHz auctions – strategies and results

All three NRAs of Baltic States held 2,6 GHz auctions by March 2012; they were based on several principles such as:

- to attract the three major existing GSM/UMTS operators in order to ensure sustainability of services;

- to provide three equal basic lots (frequency blocks) to guarantee environment for fair competition in the future;
- to ensure space for some additional bidder as local (niche) operator.

Three 20 MHz paired FDD blocks were the auction kernel in all countries; in addition one 2x10 MHz licence was successfully auctioned in Latvia and Estonia and TDD blocks were auctioned in Estonia. Nevertheless, different auction strategies were chosen.

Latvian auction (simultaneous multi-round auction format with real spectrum blocks) contained requirement to operators to cover 55% of the population till 2018 (in reality to cover 17 cities); the spectrum will be available from 2014.

The strategy of the Estonian and Lithuanian NRAs was non-typical "beauty contest" with fixed initial payments for spectrum blocks and the basic idea is clear: to save money for investments in the network. The spectrum is available immediately. Lithuanian operators have to supply 50% of population in 5 cities until 2015 and 50% of population in 15 cities until 2017. There were no direct coverage obligations in Estonia; one condition of the "beauty contest" was that the number of base stations need to be installed by the operator within the time schedule that was determined during the bidding process as well as in the license.

Evaluating European 2,6 GHz auctions' monetary results, the authors found quite strong correlation between average revenue per user (ARPU) and amount of MoB subscriptions (instead of habitual orientation on population) on one hand and price that bidders have paid for spectrum blocks on the other hand (fig. 2).

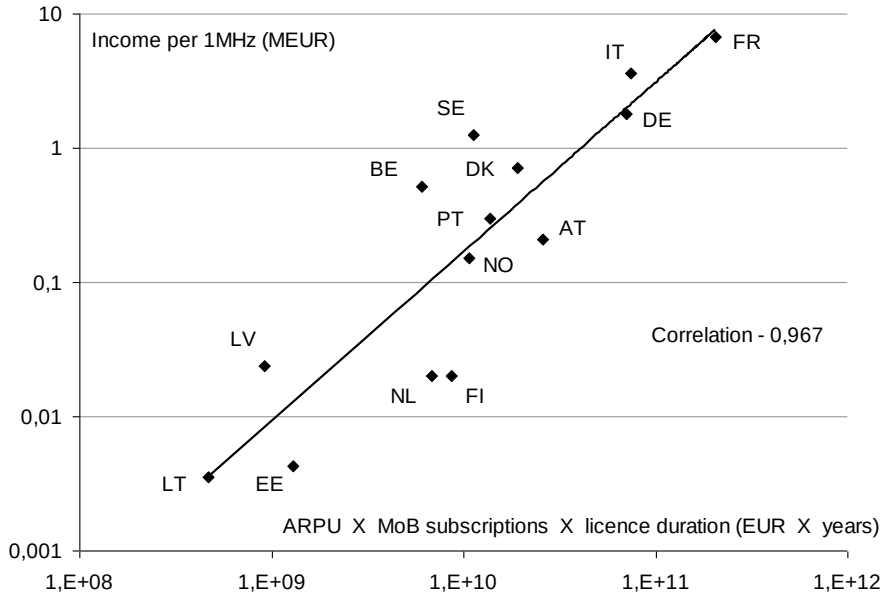

Fig. 2. 2,6 GHz auctions; trendline of generated payments.

A more detailed analysis shows the reasons that lead to significant deviations from the trendline: e.g., only three bidders in Finland, strong rollout conditions (25% of population by December 2013) in Austria and spectrum caps, which were imposed on three incumbent operators in the Netherlands, depressed auctions' prices. However, higher amounts generated in Sweden, Latvia and Belgium are connected with serious competition of bidders - in Belgium it was artificially created by announcing divergent lots.

The results of the Latvian auction clearly show its fiscal success as the generated amount is excellent for a small country with an economy that was hardly pressed by the economic crisis. The future will show if the "beauty contests" will support a more dynamic deployment of LTE networks.

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