Guest Editorial

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First launch of the next generation mobile broadband system, *Long Term Evolution* (LTE), has already been conducted (TeliaSonera in Norway and Sweden). So far, the terminal selection is limited; at the time of writing one commercial LTE only USB modem exists. However, the wheels are in motion, several vendors will provide USB modems including 2G/3G interworking this year, and the first sample of a handheld device for LTE was demonstrated at the *Cellular Telecommunications Industry Association* (CTIA) March 2010. Consequently, 4G is just around the corner; an interesting question is thus where and what will next generation bring us?

Looking back, the killer application for the first generations of mobile networks was voice telephony service. It is fair to say that the mobile communication technology has changed our lifestyle and the way we communicate. It is one of the most important innovations when it comes to changing and improving welfare and life standards. Today, the availability and accessibility to the mobile network are taken for granted, and the technology has become global mature with more than 4.2 billion connected users. We have learned to utilize our mobile device to communicate through the use of text messages, picture messages, e-mail, video messages, video casts, and social networks in addition to traditional telephony. Voice is still very important, but we are seeing a new killer application for mobile networks arising, simply mobile broadband access to the Internet. We foresee a similar evolution for data communication and access to the Internet as for voice telephony; we will be able to access the Internet anywhere at any time.

The convergence of fixed and mobile access to the Internet is happening, mainly due to the huge improvements we have observed in mobile technology the last years, ie. the performance gap between fixed and mobile is decreasing. The evolution of data rates follows the evolution trend for computing power and memory, ie. a doubling every 18 months. This provides the operators with the opportunity to offer better performance and to find more cost efficient solutions to deliver satisfactory end user experiences.

The large uptake of mobile broadband can be attributed to two main factors; marketing of the mobile access as a broadband service like xDSL and introduction of flat rate tariffs. The consequence is that the mobile data traffic shows an exponential growth. There are mainly two ways of providing the required network capacity; by increasing the base station density or by increasing the capacity per base station. The first alternative can either be based on densification of the macro network or introduction of hierarchical layered networks with micro, pico, or femto cells. The goal is to achieve a dense roll-out of the network to reduce the capacity required per site. The other alternative requires new, more efficient technology (eg. MIMO) or more spectrum. The operators' spectrum needs are both in the high capacity bands above 1 GHz, and in the coverage bands below 1 GHz. To overcome the large traffic growth, several operators have also been forced to introduce limited usage for heavy users (maximum volume per month).

The amount of information we are sharing and have access to today is increasing, and the time before devaluation of knowledge and information is declining. After a family party today it is not uncommon to have several hundred digital pictures. In the past, one picture of the family represented a high value and the picture could live 'forever'. When the lifetime of information is shortened, the need for access to updated information increases. The mobile broadband networks offer the required flexibility to be updated anywhere at any time. We will see different devices tailored for different purposes, in addition to the traditional devices; new devices like Kindle from Amazon and iPad from Apple are popping up. User devices provide access to your personal data, make it possible to look at movies and listen to music, gather and update information, and get news while on the move.

Today we have mobile access to the Internet, what will come next and what will we use it for? The continuous increase in computer power and memory size that can be integrated into the devices will make them more and more advanced. An area of research dependent on these advances in device capability is cognitive radio. Such devices will observe the surrounding environment and adjust their behaviour accordingly. Cognitive devices may for example facilitate opportunistic access to spectrum, ie. utilize spectrum if available even though the license is owned by another system. If we look to the applications, it is anticipated that more of the typical fixed entertainment services such as TV, gaming, music, and movies will move into the mobile domain. Furthermore, human behaviour in combination with location is foreseen to be important. An interesting area is wireless medical

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healthcare solutions (telemetry services), monitoring your body around the clock with measurements performed on your mobile device. Such applications can make use of the networks, where your family doctor can examine you anywhere at any time.

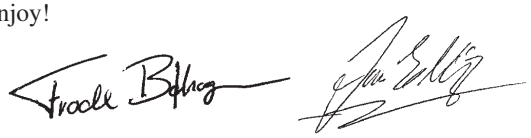
This *Telektronikk* issue is organized in three main sections. We start with an introductory section, providing background and a framework for today's mobile broadband scene; the transition from circuit centric to packet data centric networks. We follow up with a technology section, describing state of the art tools and method available for providing mobile broadband to our ever demanding customers. The last section is devoted to some selected deployment case studies, also looking into economic aspects of mobile broadband.

The introductory section starts with an article on the evolution of mobile data. It guides the reader through the technological development since data services became available via mobile and wireless systems, and describes the explosive market growth experienced and how this growth is forecasted to continue. The next article investigates the MBB users and their needs. Extra attention is given to the user group that have problems adapting to this new technology, the so-called technology strugglers. The first section is concluded with an article on status and trends in spectrum management with special focus on frequency bands for MBB.

The technology section starts with a presentation of the two main MBB radio access technologies, ie. *High Speed Packet Access* based on existing 3G architecture and *Long Term Evolution,* which is based on a new architecture. Both technologies have been developed by the 3GPP and aim at utilizing new advanced techniques to reach the high performance required. The succeeding article gives an overview of the architecture and features of the new all-IP core network coined *Evolved Packet Core*. The authors also discuss services delivery over EPC. The next article discusses an alternative technology path, namely WiMAX. The article seeks to give a tutorial overview of the technology, its current status and future development. Indoor coverage is an important topic for future MBB systems. One potential solution is utilizing lower frequencies with good propagation properties; another possibility is deploying indoor solutions, and an article on the emerging femtocell concept is included in this section. Sufficient access security is crucial for our future MBB networks, and we have included an article on this topic. It takes a brief look at access security in the 3GPP-based mobile broadband systems, with main focus on UMTS and LTE. On a level with most industries today, there is for mobile communication an increased focus on reducing the energy consumption of the networks. We have included an article discussing two major solutions; the first allowing the network to dynamically optimize its available capacity based on the traffic being carried, and the second reducing the amount of required network upgrades by accommodating increasing traffic during less busy hours. The backhaul is becoming increasingly important in providing competitive broadband mobile services. A contribution treating the backhaul topic, with special focus on gigabit radio links is provided. The last article in the technology section looks a bit further into the future and discusses a technology which is very hot in research today, namely *cognitive radio*.

The third and final section starts with a case study from the Copenhagen area where the target of the study is to investigate mobile broadband network evolution towards 2015. An economic evaluation by means of total cost of ownership is performed. The next article analyses and indentifies key properties that should be ensured to secure a profitable MBB offering. The last contribution is on experiences from the Promonte wireless broadband project. The goals of the project were to roll out an all-IP network including Fixed WiMAX, WiFi and HSPA, and to investigate the business potential related to different combinations of the technologies.

Enjoy!



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