Mobile Broadband Evolution

Securing the future of Mobile Broadband for the GSM community

LTE White Paper

Background

The GSM family of technologies including GSM, GPRS, EDGE and UMTS/HSPA accounts for more than 3.6M subscriptions, translating to a global market share in excess of 85%. Founded on open standards and with competition at every level, the well-established GSM ecosystem has delivered unrivalled economies of scale and cost performance, including sub $20 handsets.

The GSM ecosystem is now deploying Mobile Broadband services, using High Speed Packet Access (HSPA)[1] technology, faster than any other mobile technology ever deployed. There were more than 245 networks live, with more than 1100 devices from 127 different suppliers and more than 87M connections across 102 countries worldwide at the end of 2008.

Mobile Broadband can do much more than just provide faster access to online services, it can also bridge the "digital divide" and bring broadband to the billions of people worldwide who have no access to cable or DSL services and are unlikely ever to do so. There are more than 3.5 billion mobile users, covered by GSM, compared with 1.1 billion fixed-line users.

Widespread Mobile Broadband coverage, coupled with innovative new devices, such as net/notebooks with integrated radio cards or dongles, advanced handheld smartphones such as the iPhone, Blackberry Bold, Android G1 and fixed wireless terminals connecting multiple devices etc, has resulted in exponential growth in data traffic. The continued development of the GSM family of technologies is designed to ensure that the mobile industry can continue to meet this fast-growing demand for secure, always-available and easy-to-use broadband services.

The purpose of this paper is to outline the roadmap for the GSM family of technologies to 'Long-Term Evolution' (LTE). This paper will highlight the flexibility of the Mobile Broadband evolution, allowing each mobile operator around the world to deploy what they need, when they need it and in response to their own local market conditions.

After the technical diversification of previous generations, a single global standard for mobile communications is now emerging. There are several different paths to next generation mobile services, but, for the vast majority of the world's mobile operators, all of those roads will eventually lead to LTE.

1 HSPA refers to High Speed Packet Access and encompasses HSDPA, HSUPA and HSPA+ (also referred to as HSPA Evolution)

The Paths to LTE

Enabling people to use mobile services wherever they are depends on the adoption of common technical principles by a broad ecosystem of operators and equipment suppliers. In order to offer the customer a wide choice of devices and services, compatible equipment from many different suppliers is essential. Hence, the development of standards and the certification of devices via rigorous testing have been key elements in the development of mobile telecoms into the global industry it is today. Mass adoption of common technologies across the industry, has driven economies of scale in all network elements, as well as enabling users to continue using mobile services while travelling abroad.

To date, there has been widescale adoption of GSM as a 2G technology and UMTS/HSPA for 3G, between them accounting for around 85% of the global market. However, some operators have used other technologies to provide 2G and 3G services.

Standards body 3GPP has defined LTE as the next step in the technological roadmap, after HSPA. LTE offers higher data rates, lower latency and greater spectral efficiency than previous technologies. LTE is compatible with HSPA, UMTS and GSM-based technologies and hence offers a simple evolutionary path for all existing GSM and HSPA operators.

However, LTE's complementary core network also offers the ability to support the handover of services between LTE and CDMA-2000 networks, making LTE a compelling option as a next step for CDMA-2000/EV-DO operators as well.

LTE has been developed to offer both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes, enabling TD-SCDMA networks to also make a smooth transition to TDD LTE. Indeed, a combined FDD and TDD LTE deployment is expected to gain a broad foothold in many markets.

LTE is set to build on the economies of scale and benefits that have driven the adoption of GSM, UMTS and HSPA. With strong support from the CDMA-2000 and TD-SCDMA communities, LTE will become the common, unifying technology for the entire mobile telecoms industry. As the default next generation network technology being adopted by almost all operators in the world, LTE will ultimately enable true anytime, anywhere connectivity for mobile broadband users.

When to deploy LTE

Mobile Broadband services using HSPA and EV-DO have been deployed across a wide range of markets, driving the development of new applications and services. HSPA has driven the rise of the Mobile Broadband dongle, made the Internet experience on the iPhone, the G1, the Bold and other smartphones so compelling, and motivated laptop manufacturers to add embedded mobile connectivity to their models. TD-SCDMA, whilst not deployed on the same scale, is fostering similar developments.

So why are operators preparing to deploy LTE?

Operators that have either deployed, or are planning to deploy HSPA, are faced with a choice – curtail HSPA investment and move to LTE rapidly, or continue to invest in HSPA, HSPA+ and future releases, before introducing LTE at a later date.

Influencing factors include:

- How recently the operator purchased radio infrastructure equipment, and the associated business case to recoup the investment related to that equipment.
- The capital outlay for upgrade of existing technology versus deployment of new technology.
- Whether the current network supports sufficient data rates and subscriber density to meet customer demand.
- Availability of spectrum

The extent to which each of these factors influences any individual operator will vary. Thus, in practice, it is unlikely that any two operators will be faced with identical circumstances, meaning there will be a broad spread of adoption strategies. These will range from aggressive LTE deployment in markets where demand for Mobile Broadband is high, to a longer term strategy to move to LTE where the Mobile Broadband market is relatively new or can be addressed by HSPA and HSPA+ and its evolution for some time to come. There is also a possibility that, where HSPA is not currently deployed, the HSPA step could be skipped completely and operators will move directly to LTE.

The decision for operators of networks based on EV-DO, TD-SCDMA and other technologies is affected by the same factors as for those within the GSM community, with the following additional factors also affecting their choice:

- Customer demand for bandwidth may go beyond that achievable with their existing technology evolution path.
- The opportunity to join to the family of technologies used by the majority of the global mobile telecoms market and hence benefit from economies of scale, a wide choice of devices and roaming revenue.
- Availability of core network functionality to allow interworking between LTE/EPC networks and their existing networks.

The combined set of deciding factors make LTE a compelling choice for these operators as well.

The net result is that regardless of how they get there, the vast majority of mobile operators will deploy LTE at some point in the future.

The Spectrum Question

The continued success of GSM and its related technologies has been driven by the use of a common underlying technology and coordinated spectrum planning across markets worldwide. GSM and WCDMA deployments use specific ranges in the radio spectrum, so that the radio interfaces developed by chip manufacturers are applicable across many different markets and, as far as possible, are not fragmented into national or regional variants. This harmonisation drives down costs in the chip market and enables customers of one network operator, to roam on to networks of other operators without a discernable difference in service.

For deployment of LTE to be successful globally, similar spectrum co-ordination needs to take place. This is a difficult task to achieve since spectrum availability becomes increasingly limited as more and more radio technologies are deployed both in mobile networks and other applications, such as broadcast television and government bodies. Unlike previous technologies, LTE has been designed to be able to use a range of spectrum bandwidths, from a few MHz up to 20 MHz wide, meaning that LTE can be deployed in parts of the spectrum that could not be used for HSPA.

However, flexibility alone is not enough. Spectrum for deployment of LTE will be available in high frequency ranges – 2.5 GHz and 3.5 GHz – but as the frequency increases, cell size decreases and the ability of radio waves to penetrate walls is reduced making in-building coverage difficult.

Using lower-frequency spectrum, such as that freed up by the 'Digital Dividend', would reduce or remove some of these problems. At the point when analogue television signals are turned off, a portion of the spectrum in the range 470-862 MHz range will become free. This spectrum represents a sweet spot for mobile services, offering the best coverage. While the majority of this spectrum will be needed to provide digital television services, it is important that governments worldwide allocate at least 100 MHz for mobile services, enabling operators to provide coverage with fewer base stations and at much lower cost. This, in turn, would mean that rural communities that are currently unreached by existing broadband networks – both wired and wireless – could be covered. Use of this low-frequency spectrum would also further improve coverage in suburban areas and within buildings, enabling people to remain continuously connected to mobile broadband and thus bridging the digital divide.

It is also important that governments and their regulators, at least at a national level, allocate the same minimum 100 MHz of Digital Dividend spectrum for mobile services, enabling equipment suppliers to sell the same network units and devices across many different markets and achieve economies of scale, thus lowering the cost to end-users.

Market Expansion and Proliferation

HSPA Mobile Broadband has been an unprecedented consumer market success in markets where it has been launched. However, the availability of a high bandwidth mobile network has started to trigger the development of new applications and services in non-consumer segments. Applications and equipment that use Mobile Broadband connectivity are already found in eHealth, machine-to-machine communications, telemetry, logistics and tracking systems and for offering connectivity on public transport.

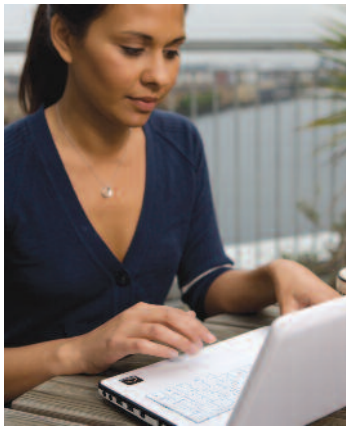
By providing greater capacity and better performance, LTE will make applications in new business sectors more prevalent and more compelling.

Mobile Broadband: A Consumer Perspective

The GSMA has led the development of the Mobile Broadband service mark to inform end users that the device they are buying is equipped with the necessary technology to support high data rates via mobile networks. The average customer is not aware of, and does not care, what the specific technology that underlies this service is. Regardless of whether it is HSPA, HSPA+ or LTE, end users will expect to be able to connect to and use services anywhere they want. This means that the operator has to deliver against that customer expectation – the end user will not want to see or feel the movement between one technology and another; the operator will need to support technologies offering as close to a seamless end user experience as possible.

As an evolution of an existing, widely-deployed technology, LTE is perfectly placed to deliver against that expectation. Mobile Broadband is driving new consumer and business applications and new specialised devices, such as gaming machines, internet tablets and cameras with embedded modules. All of these will carry the Mobile Broadband service mark, telling the consumer that their device, regardless of the form factor, can connect to services and applications across the world. The strength of such a service mark and the ecosystem that needs to lie behind can only come about through the mass adoption and implementation of a single, standard technology.

Mobile Broadband™



Conclusions

LTE deployment will begin in the near future, and whilst not all mobile operators will move immediately to LTE, almost all will have deployed that technology within the next ten years, and some will be much earlier. This shared strategic direction represents a massive opportunity for the world to benefit from ubiquitous availability of Mobile Broadband connectivity. Not only will consumers and business users be able to surf the Internet and access other online services at ever faster speeds on a very broad range of devices, Mobile Broadband will also generate very substantial social and economic benefits in previously unconnected communities and markets.

For LTE to drive these benefits, co-ordinated and co-operative deployment is needed. Mobile network operators will fulfil part of this by mass adoption of LTE as a unifying technology across the global market, but realising the full potential of Mobile Broadband services depends upon the use of common spectrum bands for LTE, particularly in the low frequencies below 1 GHz.

As the applicability of Mobile Broadband becomes even more clear over the next few years, LTE will appear in new devices, new applications and drive creativity across a huge range of industrial sectors. Whilst the mobile telecommunications market has a very clear direction, it could be that other segments will soon have the same mantra – "All Roads Lead to LTE".

About the GSMA

The GSMA represents the interests of the worldwide mobile communications industry. Spanning 219 countries, the GSMA unites more than 750 of the world's mobile operators, as well as 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organizations. The GSMA is focused on innovating, incubating and creating new opportunities for its membership, all with the end goal of driving the growth of the mobile communications industry.

For further information please visit:
www.gsmworld.com/HSPA

GSMA London Office
1st Floor, Mid City Place, 71 High Holborn, London WC1V 6EA, United Kingdom
T +44 (0) 20 7759 2300