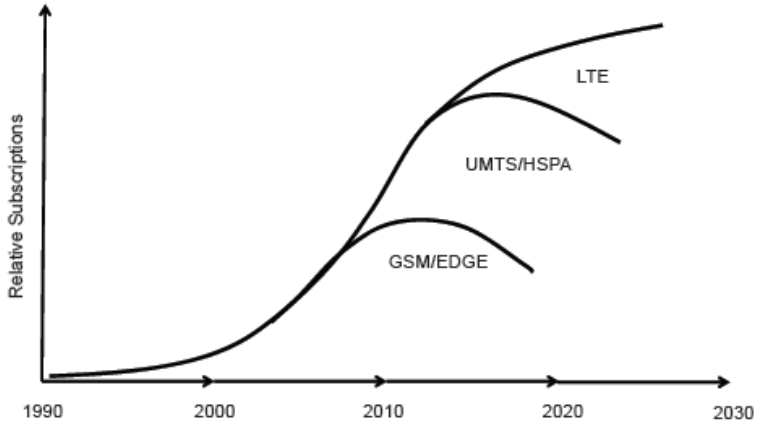
HSPA & LTE Advancements

(February 2012)

The ever increasing importance of mobile broadband to the vitality of communities across the globe continues to put focus on expanding the capacity of mobile networks to serve consumers' needs. Two vital tools for expanding mobile networks capacity are: (i) adding additional spectrum allocations to mobile and (ii) improving the technical effectiveness of utilization of the existing spectrum resources. GSMA will continue to work with policymakers and regulators to help secure additional spectrum in a sensible and expeditious fashion. The purpose of this paper is to provide an overview of current efforts to enhance the performance and efficiency of mobile broadband technologies. In so doing, spectrum resources can be utilized as intensively as possible to expand mobile network capacity.

These efforts take the form of ongoing specifications efforts within the Third Generation Partnership Project ('3GPP'), a collaboration of regional standards organizations from across the globe. There are two principal branches of this effort for 3GPP based Radio Access Networks ('RANs'). One is devoted to the evolution of High Speed Packet Access ('HSPA'), the other to advancing Long Term Evolution ('LTE').

These efforts are synergistic and mutually reinforcing, for a variety of reasons. First, HSPA enabled mobile broadband technology will continue its expansion through the middle of the decade, which will be followed by the marked ascent of LTE.



Graphic depicts relative penetration levels for the various technologies. Differences in vertical dimension between lines represent number of devices pertaining to the relevant technology. Source: 4G Americas/Rysavy Research

It will be vital to support interoperability between both technologies in order to foster roaming, seamless coverage, service continuity and other important objectives.

Second, a number of technical solutions are relevant for the development of both HSPA and LTE beyond that latest iteration ('Release 10') of 3GPP's specifications frozen in March 2011, and into Release 11 which is scheduled to be frozen in September 2012. Solutions such as making as much use as feasible of disparate spectrum allocations, and boosting cell edge performance, manifest themselves in both HSPA and LTE networks. Techniques to address such issues are being developed with applicability to more than one technology wherever possible.

Regarding **HSPA**, 3GPP is pursuing a package of HSPA enhancements that promise to yield significant benefits. In particular, these enhancements could ultimately result in better cell edge performance, improved system efficiency, and substantially higher peak data rates. 3GPP's intent is to support opportunities for commercial deployment of these technologies in the 2013 timeframe. Techniques being progressing by 3GPP to enhance HSPA and LTE include the following:

- *Multicarrier Aggregation*

  Release 10 currently supports aggregation of up to 4 downlink carriers (spread across one or two frequency bands). Release 11 envisions the combination of up to eight carriers in the downlink from different frequency bands.

- *Coordinated Multipoint Transmission*

  This feature set would increase the cell edge data rate by allowing the user to download data from multiple base stations at the same time.

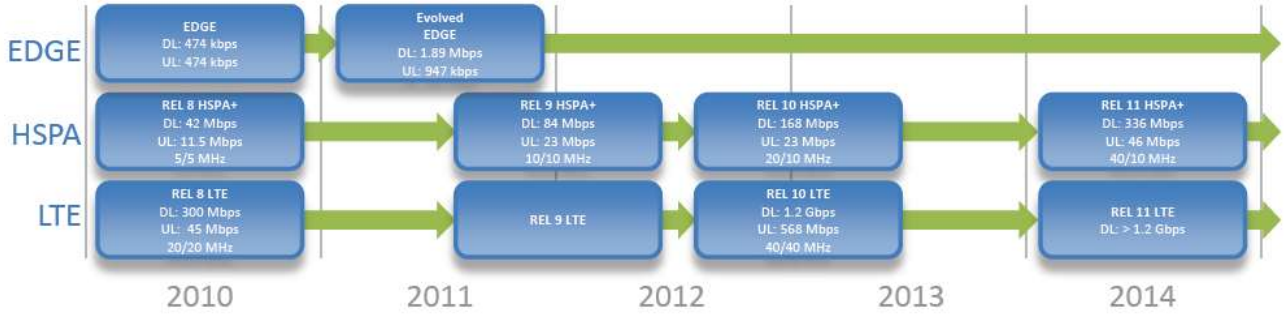
- *Uplink Enhancements: Dual Antenna Beam forming and Multiple-Input-Multiple-Output ('MIMO')*

  This combination of enhancements would improve average and peak uplink data rates via transmission of dual streams, resulting in improved link budgets benefitting cell-wide as well as cell-edge average data rates. In addition, the uplink dual stream MIMO feature standing alone could under certain scenarios double the uplink peak rate.

- *Self-Optimizing Networks ('SON')*

  The intent of this set of features is to facilitate the self-configuration, self-optimization and self-healing of mobile networks. The result would be a material reduction in the time, cost and effort required to manage and enhance mobile broadband networks.

LTE promises dramatic advances in the capabilities of 3GPP technologies, as illustrated in the following graphic.



Throughputs are peak theoretical network rates; future dates are expected initial commercial network deployments. Source: Adapted from Rysavy Research/4G Americas.

These capabilities are the result of past, present and future efforts within 3GPP to progress LTE technology. As alluded to previously, there is appreciable overlap in the basic concepts being used to innovate in both LTE as well as HSPA, as for example with advanced antenna techniques and MIMO. Additional areas of innovation in LTE include the following:

- *Multicarrier Aggregation*

  Release 10 supports carrier aggregation in the downlink of up to 100 MHz of total bandwidth for LTE. Release 11 will build on these features by for example supporting additional frequency bands.

- *Local IP Access ('LIPA')*

  Together with advancements in home eNodeB ('HeNB') functionality, LIPA features will help support traffic offload from the macro network to local access networks.

- *Relays*

  Building on the legacy role of repeaters in enhancing coverage, 3GPP aims to dramatically increase the sophistication and value of these nodes. More advanced Relay Nodes ('RNs'), capable of operating not only at the physical layer but also at layers 2 (media access) and 3 (transport), would support advanced network management techniques that among other things would minimize the interference that has historically plagued relays.

In conclusion, these are but a few of the many initiatives being developed by 3GPP to evolve HSPA and LTE technology. Their commercialization will help intensify use of existing, scarce spectrum resources and improve mobile broadband services. It should be noted, however, that these technology developments are not a substitute for the allocation of addition spectrum for mobile broadband networks. Such additional allocation continues to remain of paramount importance, with HSPA and LTE technology innovations complementing those endeavors.

For further information, please consult the following documents:

1) 3GPP home page
   http://www.3gpp.org/

2) Nokia Siemens Networks White Paper - "Long Term HSPA Evolution" (Dec. 2010)
   http://www.nokiasiemensnetworks.com/portfolio/products/mobile-broadband

3) Ericsson White Paper - "HSPA Evolution" (July 2011)
   http://www.ericsson.com/res/docs/whitepapers/WP-HSPA-Evolution.pdf

4) Agilent Application Note - "Introducing LTE-Advanced" (July 2011)
   http://cp.literature.agilent.com/litweb/pdf/5990-6706EN.pdf