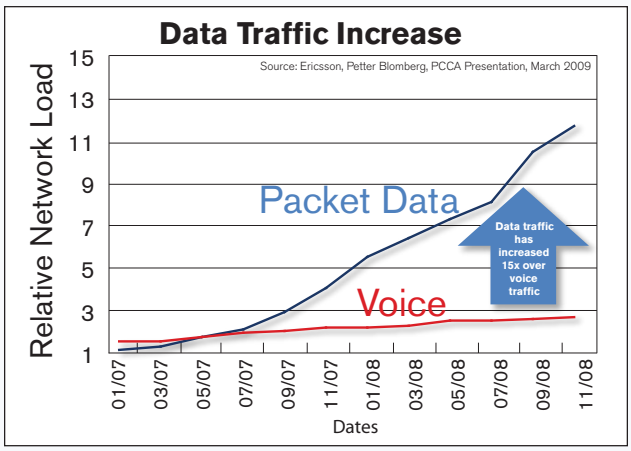
The Mobile Broadband Future: HSPA+ and LTE

An educational feature brought to you by 3G Americas and Wireless Week

Mobile Data – Promises Delivered

The mobile industry has been talking for many years about the day when the promise of substantial mobile data revenues would actually become a reality. Much to everyone's delight, that day has finally arrived.

Just look around in any public setting and you'll see people texting, doing their email, surfing the web and even downloading music on their wireless devices. And if anecdotal evidence isn't good enough, then the real proof is in the numbers. While voice still accounts for the majority of cellular traffic, in the U.S. for the first time since 1998, voice average revenue per user (ARPU) dipped below $40, and overall ARPU from data reached almost 25% in 2008 and is likely to exceed 30% by the end of 2009, according to Chetan Sharma Consulting. Sharma reports that U.S. wireless data service revenues grew 38.7% in the fourth quarter of 2008 compared to the fourth quarter of 2007. Additionally, global mobile data revenues showed a 47.2% year-to-year increase worth a total of $200 billion between 2007 and 2008, according to Informa Telecoms & Media.



Operator Assessment of Growth in Data Demand on a Relative Basis

In 2008, there were almost 162 million smartphones sold, surpassing notebook sales for the first time, according to Informa Telecoms & Media. Informa forecasts sales of new smartphones in 2009 will grow more than 30% to 211.2 million units, driven by innovative new devices and operator subsidies designed to promote mobile data consumption, so that by 2013 almost four in every ten handsets sold worldwide will be a smartphone.

While voice will always be important, mobile data is taking the driver's seat as mobile operators develop their near- and long-term technology strategies. To meet and exceed their subscribers' expectations and requirements, mobile operators must offer new, innovative mobile data applications. They also must support a seamless experience that provides end-users with the access and ability to use the data-centric applications they use at home, in the office or on the go anywhere in the world.

Evolution to LTE

The road to the mobile broadband future has several paths and each mobile operator will have different timetables and reasons for taking one path over another. But seemingly all agree on the ultimate goal – an efficient all-IP wireless network capable of supporting voice, video and data services. Choosing the air interface best suited to meet the needs of tomorrow's IP-based services is the key to reaching that goal. In addition to impacting their access and core networks, the choice they make also impacts the simultaneous evolution of the entire wireless ecosystem including devices, applications and services.

For many years now a true world cellular standard has been one of the industry's goals. GSM dominated the second generation (2G) technologies but there was still fragmentation with CDMA and TDMA as well as iDEN. With the move to third generation (3G), nearly all TDMA operators migrated to the GSM technology path. Yet the historical divide between GSM and CDMA remained. It is with the next step of technology evolution that the opportunity has arisen for a global standard technology. Many mobile operators have converged on the technology they believe will offer them and their customers the most benefits. That technology is *Long Term Evolution (LTE)*. For the first time in the world, a future technology standard has spanned the U.S., Asia and Europe with commitments from leading operators on their planned deployment of LTE and a global consensus that LTE will become the dominant technology for the next generation of mobile broadband.

In June of 2008, the Next Generation Mobile Networks Alliance (NGMN) selected LTE as the first technology that matched its requirements successfully. The GSMA, UMTS Forum, 3G Americas and other global organizations have reiterated their support of the 3GPP evolution to LTE. Additionally, the LTE/SAE Trial Initiative (LSTI) has provided support through early co-development and testing of the entire ecosystem from chipset, device and infrastructure vendors. LTE is in the early stages of its evolution, but several of the world's largest mobile

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operators have announced trials beginning in 2009 and initial deployments as early as 2010 and 2011. The future for LTE and its already impressive ecosystem is evidence of a well-defined standard and there are already more than *100 operators worldwide* who have plans for LTE in their future.

"Because of practical benefits and deployment momentum, the migration path from EDGE to HSPA then to LTE is inevitable. Benefits include the ability to roam globally, huge economies of scale, widespread acceptance by operators, complementary services such as messaging and multimedia and an astonishing variety of competitive handsets and other devices," according to a Rysavy Research *EDGE, HSPA and LTE Broadband Innovation* report.

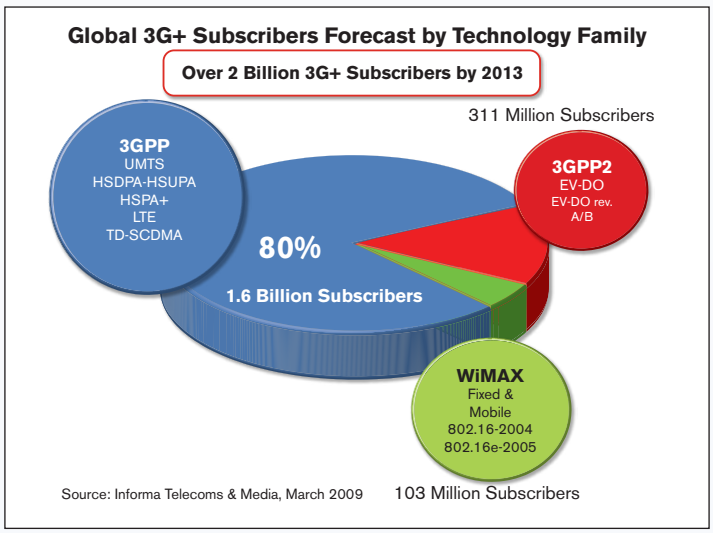
While LTE is off to a great start, it will not be deployed worldwide overnight. It will take until at least 2015 for a large percentage of subscribers to begin connecting to LTE networks, according to the Rysavy report. It will take even longer for LTE networks to supplant existing GSM/UMTS/HSPA and CDMA 2000 networks. This means that many different kinds of networks will coexist together for most of the decade to come.

"Virtually all of the traditional wireless industry is converging on one air interface [LTE], but everyone is coming at it from different legacy technologies," says Michael Thelander, CEO and founder of Signals Research Group. "Some operators may begin turning off their 2G networks in the coming decade but it will be well more than a decade before 2G networks no longer exist in at least some markets and I will be long retired from the industry before the same can be said for today's 3G technologies."

Bridge to the Future

Because the evolution to LTE will take years, mobile operators able to do so will continue to upgrade their existing 2G/3G networks to constantly improve the mobile broadband experience for their customers. With 3.6 billion subscriptions for an 89% share of the global market, and 750 networks in 219 countries worldwide, the GSM-HSPA family of technologies will serve the overwhelming majority of mobile customers for the next ten years even as LTE is commercially deployed.

"We have a great story. We're not the best because we're bigger, we're bigger because we are the best," says Chris Pearson, President of 3G Americas. "And that goes for the entire evolution of our 3GPP technology family."



Global Mobile Broadband Subscription Forecast 2013

With 85% of the global 3G mobile broadband market today and more than 1100 devices commercially announced by 132 suppliers supporting a broad portfolio of mobile data services, it's clear that UMTS-HSPA will have a significant impact on the evolution of mobile broadband in both the near-term and for the foreseeable future.

Because of its many benefits, many UMTS-HSPA operators will choose to deploy HSPA+. An affordable, simple and incremental upgrade to existing HSPA networks, HSPA+ provides mobile operators with significant increases in technology network performance as well as reduced latency on their way to LTE. This is a tremendous advantage of HSPA operators that is not an option for CDMA operators who are already unable to compete with the higher data throughput performance of HSPA and have no future evolution commercially viable for enhancement to their EV-DO networks today.

Because it offers such impressive performance at an incremental cost, some UMTS-HSPA operators plan to use HSPA+ as a bridge to LTE. Telstra launched the world's first commercial HSPA+ network in February of 2009. In the U.S., both AT&T and T-Mobile USA have committed to evolving their UMTS-HSPA networks to HSPA+ to continue increasing performance. AT&T announced they will begin trials of HSPA+ this year. Analysts anticipate commercial service to begin in the United States in 2010.

"HSPA+ is going to be an exciting opportunity for us and our customers," says Neville Ray, Senior Vice President of Engineering and Operations for T-Mobile USA, which deployed its 3G network to more than 130 cities in 2008. Ray points out that the wireless industry is already heavily committed to HSPA. And with a thriving ecosystem in place, HSPA can evolve to HSPA+ to deliver compelling data speeds that meet the advanced wireless needs of customers.

Initial deployments of HSPA+ can deliver peak theoretical downlink throughput rates of 21 Mbps, and this speed will be doubled by later HSPA+ technology enhancements, providing a comfortable bridge to future technologies.

Kris Rinne, Senior Vice President, Architecture and Planning for AT&T, agrees

that the worldwide embrace of HSPA+ will mean that carriers, infrastructure providers and device manufacturers will be able to take advantage of a huge ecosystem that offers advantages to both service providers and end users.

"The advantages of being on the path we are on include the global scale and international roaming that we can offer our customers due to the GSM technology family," says Rinne.

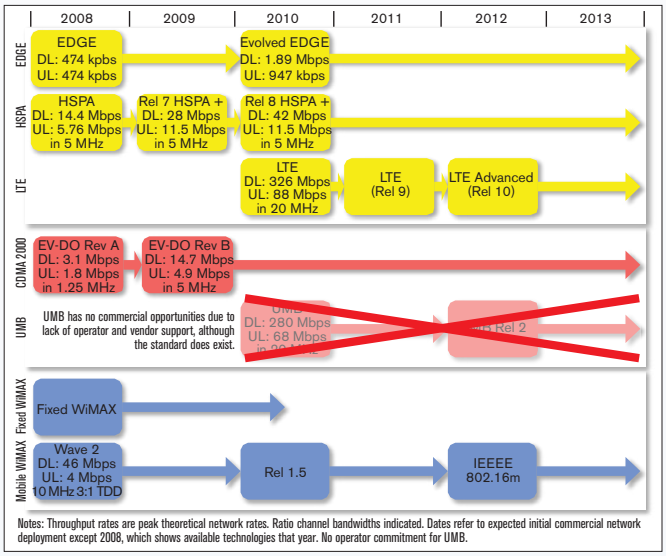
AT&T, which has experienced 50% data revenue growth year-to-year for the past three years, began the first widescale deployment worldwide of the initial HSPA technology in its 850 and 1900 MHz networks in 2005. Since then, both AT&T's HSPA network and the HSPA ecosystem have matured – AT&T has the fastest nationwide mobile broadband network in the U.S. and HSPA offers a robust portfolio of handsets and services available today, she adds.

"The beauty of the GSM family of technologies built on the 3GPP technical specification is that devices for future technologies can 'fall back' on existing global GSM family technologies services," explains Pearson. "New deployments of LTE, for example, will allow roaming on GSM-HSPA networks worldwide. This global GSM-HSPA coverage is something that other new mobile broadband technologies will never have the ability to achieve even over the course of many years."

Recent spectrum auctions in the United States have laid the groundwork for deployment of LTE. For example, AT&T will use LTE to build out the 700 MHz and (1700-2100) AWS spectrum it won at auction, according to Rinne. AT&T announced its support of LTE in 2008 and has trials of LTE in 2010 with potential commercial launch of LTE in mid 2011.

"LTE provides us with some incremental benefits in terms of how it is designed to operate across the broad radius of the cell site itself," says Rinne. "The technology's high spectral efficiency, combined with the flatter architecture of the network means that operational expenses will be reduced for carriers. LTE can also be used on a wide range of different spectrum, making it ideal for carriers throughout the globe."

LTE will be a data-centric technology for years to come, but it is the technology that mobile operators will use to begin supporting VoIP, says Thelander. Until then, LTE handsets will be dual-, or even tri-mode. "But because LTE is designed to be backwards compatible with GSM/UMTS/HSPA, mobile operators such as AT&T can deploy the new technology as aggressively as they wish and continue to provide their customers with a seamless, full-featured experience wherever they go," Rinne adds.



Mobile Broadband Technology Capabilities

Source: EDGE, HSPA & LTE, Mobile Broadband Innovation, Rysavy Research September 2008

Many mobile operators with the current EV-DO technology will likely deploy LTE because upgrades to their technologies such as Ultra Mobile Broadband are not commercially viable or available. In fact, leading CDMA operators worldwide including Verizon, KDDI, KTF and SKT are among those confirming that they will converge with the 3GPP world, selecting LTE over other radio access methods as they are nearing the end of their existing technology roadmap. In China, the future evolution for TD-SCDMA is a smooth convergent path to TD-LTE. Additionally, WiMAX operators may begin to consider LTE as the LTE TDD and FDD ecosystem is developed and Clearwire has publicly stated their intention to evaluate LTE for future deployments while Sprint is rumored to be considering LTE.

Next Level

HSPA+ and LTE will likely seamlessly coexist for many years to come, but mobile operators that reach capacity limits with existing technologies will want to take their networks to the next level of efficiency that uses the OFDMA radio access technology. Deployment of LTE enables mobile operators to operate their networks across 1.4 to 20 MHz of spectrum and grow their networks even further and more efficiently on top of an all-IP backbone. Ultimately, LTE will provide them with even more efficiency by enabling them to move their voice traffic onto VoIP.

Because operators require different solutions to meet the needs of their customers, the pace and progress of the LTE evolution will depend on the market they serve, the tools that they have in their arsenal as well as where they are in terms of penetration and growth of their networks and the associated demands that entails.

"The GSM to LTE family of technologies gives a lot of different tools and capabilities to mobile operators, regardless of their spectrum demands or where they are in that growth curve," says Rinne. "And it enables their customers to enjoy the benefits of global roaming and a rich ecosystem of services and devices from which to choose."

3GPP Release 8 HSPA+ and LTE

The 3GPP roadmap from HSPA to HSPA+ and then to LTE has been well defined in standards development work with the final closing of Release 8 in March 2009. Some of the key features of HSPA+ and LTE include the following:

- HSPA+ is a simple upgrade to HSPA networks today, protecting an operator's investment in the network
- HSPA+ provides a strategic performance roadmap advantage for incumbent GSM-HSPA operators providing OFDMA-equivalent performance in 5X5 MHz spectrum allocations with only incremental investment
- HSPA+ will significantly increase HSPA capacity as well as reduce latency below 50 msec
- The first phase of HSPA+ with 64QAM is already being deployed by some operators providing a peak theoretical downlink throughput rate of 21.6 Mbps
- HSPA+ with 64 QAM and advanced antenna techniques such as 2X2 Multiple Input Multiple Output (MIMO) can deliver 42 Mbps theoretical capability on the downlink and 11.5 Mbps on the uplink and could be ready for deployment in 2010
- LTE, a high-data rate, low latency radio-access technology, is the next evolution beyond HSPA and will utilize Orthogonal Frequency Division Multiple Access (OFDMA) technology
- LTE with MIMO and in larger spectrum bandwidths will allow operators to achieve peak theoretical throughput rates of up to 326 Mbps in the downlink and 86 Mbps in the uplink in 20 MHz and with 4X4 MIMO, according to 3GPP
- LTE features include:
- scalability to operate in spectrum as narrow as 1.4 MHz or as wide as 20 MHz
- flexibility to operate in both TDD and FDD modes
- reduced latency needed to support sophisticated voice and data applications
- 10 msec round trip between user equipment and the base station, and less than 100 msec transition time from inactive to active.

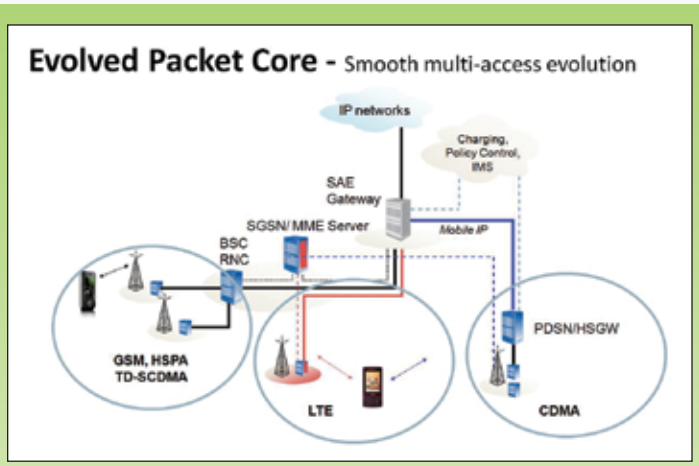


For more information:
The Mobile Broadband Evolution: 3GPP Release 8 and Beyond - HSPA+, LTE/SAE and LTE-Advanced and *EDGE, HSPA and LTE – Mobile Broadband Innovation* white papers, *www.3gamericas.org*

About 3G Americas

3G Americas is an industry association with a mission to promote, facilitate and advocate for the deployment of the GSM family of technologies including LTE throughout the Americas. 3G Americas has contributed to the successful commercial rollout of GSM across the Americas and its place as the number one technology in the region, as well as the global adoption of EDGE. The organization aims to develop the expansive wireless ecosystem of networks, devices, and applications enabled by GSM and its evolution to LTE. Members: Alcatel-Lucent, AT&T, Cable & Wireless, Ericsson, Gemalto, HP, Huawei, Motorola, Nokia Siemens Networks, Nortel, Openwave, RIM, Rogers, T-Mobile USA, Telcel, Telefonica and Texas Instruments. *www.3gamericas.org*

Core & Service Evolution



As mobile operators add HSPA+ and LTE to their radio access networks, they will simultaneously evolve the rest of their network and subscriber devices. They will beef up their core and backhaul networks to handle the exponential increases in IP traffic enabled by HSPA+ and LTE. To keep their networks performing optimally, mobile operators will flatten their core network architectures considerably using Evolved Packet Core (EPC) technology. EPC reduces the number of nodes in the core, which reduces latency even as the amount of data traffic increases. It simplifies deployment of IP-based networks and reduces the cost of their deployment.