Technology Article

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Should LTE Be Deployed Differently than 2G and 3G?

By Manish Singh, CTO

Long Term Evolution (LTE) is the new emerging standard for 4G wireless networks. While purists would argue that LTE is still a 3G wireless technology because it's part of the IMT-2000 family, there's little doubt that LTE will represent a quantum leap for the telecom world.

To wit: LTE deploys orthogonal frequency division multiple access (OFDMA) and multiple input / multiple output (MIMO) techniques to deliver peak data rates of 100 Mbps+ downlink and 50 Mbps+ uplink – a 7-fold increase from today's 3G High Speed Packet Access (HSPA) networks delivering 14 Mbps max.

That's a big change, and subscriber usage and behavior patterns will likely morph in unexpected ways as a result. What's more, an LTE network can overlay an existing 3G/2G network because LTE's evolved packet core (EPC) will ensure seamless handoffs between LTE and legacy networks – which opens the door to new types of rollout strategies heretofore considered impractical.

The Perfect (Data) Storm

Ever since the rollout of HSPA networks and flat-rate pricing plans, the wireless industry has seen unprecedented growth in mobile broadband average revenue per user (ARPU). Consumer adoption curves are off the charts, and as wireless voice ARPU hits the flat-rate ceiling, data ARPU will be the next big growth

engine for mobile operators. The main driver for this growth in data revenues is simple: Internet-savvy users are now being armed with Internet-friendly handheld devices which give them the means to satisfy their need for content and "connectedness" while away from the trusty Ethernet cable.

What's more, as social communication patterns evolve due to increasing frequency of electronic contact (e.g., Facebook, Twitter), there will be an ever-growing demand for new and innovative applications that capitalize on the simultaneous voice and data sessions available with LTE. The data revenue opportunity is ripe.

Figure 1. *The market drivers for LTE's increased capabilities are clear*

The real stimulus for this upcoming step-function of increased data usage was the "all-you-can-eat" packages that many operators introduced in Europe and North America during the past five years. Because flat-rate pricing plans don't condition customers to track or limit their daily megabyte consumption levels, applications and downloadable content have been getting more portly (i.e., data-heavy) by the day.

The beauty of flat-rate plans is that it has accelerated the mobile broadband adoption curve – but the beast is not far behind, for operators must now drive down cost / bit quickly in order to meet exploding demand while also earning a profit in the process. It's a tough challenge and the "old" approach to deploying a new technology may not suffice.

Cost/Capacity Challenges

To most, it's clear enough that there's sufficient demand for mobile broadband; there are already plenty of applications and content types that will quickly use up the 100 Mbps+ peak downlink data rates that LTE promises. However, consumers constantly expect more for less and will not necessarily pay any more for a 7X increase in data rates – and certainly not 7X more.

The good news, though, is that LTE promises a 4X increase in spectral efficiency. But for the economics to work, more network cost optimization will be needed for LTE in order to significantly lower the price/bit.

Operators therefore need to address some basic, key questions as they develop their LTE network rollout strategies:

- How do they build more "capacity" in their networks to meet surging demand?
- Where do they build more "capacity" in the network?
- How do they drive down cost / bit while not also draining the bank account?

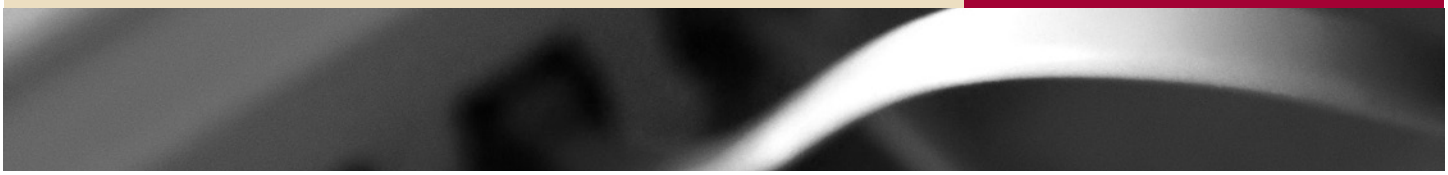
The answers to these questions require a deeper understanding of subscriber behavior and expectations. For example, in today's mobile networks, almost 60% of voice calls originate and terminate indoors; will data usage patterns be any different?

Recalling The 3G Experience

To address some of these basic questions regarding LTE deployment, mobile operators must recognize some of the key lessons learned from previous 3G network rollout experiences. Let's recall:

- While broad 3G coverage was originally promised for the year 2000, strong 3G adoption really only started in late 2006 – more than 5 years later.
- Wireless spectrum was (and still is) very expensive; mobile carriers paid billions of dollars for acquiring 3G licenses. Because of the delay, operators' return on investment was also delayed by more than 5 years.
- That expensive 3G spectrum was not even "beachfront" property as it turned out. Operators and subscribers quickly realized that poor indoor signal penetration in the 2.1 GHz band was a real problem for customer satisfaction.
- Citywide and nationwide network builds required huge up-front capital expenditures – and until 3G adoption became mainstream, all that investment produced negligible revenue and return on investment (ROI).

Summing it up, to meet today's growing demand for higher bandwidth as well as increased coverage and quality, wireless operators must find ways to augment capacity in their networks in a cost-effective, scalable manner that minimizes upfront investment and risk.



Enter Femto

As you might imagine, there's a technology solution to these business problems: femtocells. A femtocell is a small wireless base station that resides in a consumer's home and provides a standard 3G air interface so that any existing 3G handset can work seamlessly indoor – while using the consumer's IP broadband connection (such as DSL or cable modem) to connect the femtocell to the operator's 3G core network.

Over the last 2 years, femtocells have generated enormous interest from mobile operators because they address some of the very basic – yet very important – challenges these operators face: increased coverage, higher capacity and reduced churn.

Femtocells: LTE's Most Valuable Player?

I believe mobile operators must leverage LTE femtocells, also known as Home eNodeBs (HeNBs), as part of their LTE network rollout strategy. Femtocells promise to become a complete game-changer because they enable carriers to build their LTE networks one household at a time, one femtocell at a time – which matches investment with revenue and keeps the ROI model right-side up.

In contrast to the 3G deployment experience, femtocells empower operators to avoid huge upfront capital expenditure in building citywide and nationwide LTE networks. Femtocells enable operators to augment capacity where it is needed the most – inside homes, offices, cafes, airports, etc. – while leveraging their existing 3G networks to provide citywide and nationwide coverage, albeit, initially at lower data rates (remember, LTE networks can overlay over existing 3G networks).

This femtocell-based rollout strategy changes the operator's LTE business model completely and greatly reduces upfront investment and risk.

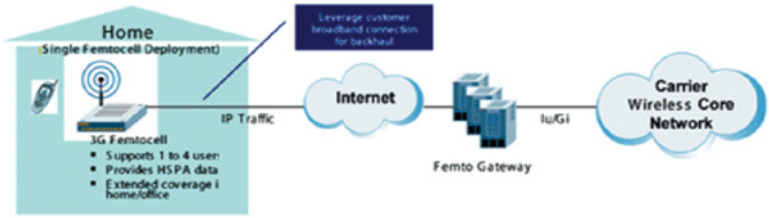


Figure 2. *Femtocells extend indoor coverage and leverage existing IP connections*

Clearly, there will be a tipping point when it will make economic sense for operators to build citywide macrocell LTE networks. Until then, femtocells enable highly targeted network expansion in line with market demand and carriers' investment cycles. The femtocell may truly become LTE's most valuable player in the network rollout game.

Reality Check

Femtocells are expected to achieve price points similar to those of other popular consumer electronics items (e.g., sub-$200) and represent the cheapest cell sites an operator can deploy while simultaneously augmenting network capacity. Site acquisition, power, cooling, and backhaul costs are virtually zero for a femtocell because the device sits on a consumer's desk or shelf and the broadband IP connection is directly paid for by the subscriber. Overall, femtocells drive down the price / bit for the operator significantly as most of the cost burden is passed on to the consumer – an infinitesimal increase to household expenses when flat-rate broadband connections already exist.

Crawl, Walk, Run...Fly!

LTE deployments are expected to begin in 2010. For mobile operators, the time is now to develop their LTE network rollout strategies and influence network equipment providers (NEPs) to deliver products that match their strategy. With LTE femtocells, mobile operators can take a crawl, walk, and then run approach – starting the LTE network rollout with Home eNodeBs, one household at a time. Enacting such a strategy enables operators to deliver capacity and higher data rates to the places where there is the greatest need.

And, because LTE lends itself well to seamlessly co-existing with operators' 3G networks, carriers can get to market quickly with new services and higher data rates without the huge up-front capital expenditures normally required for building

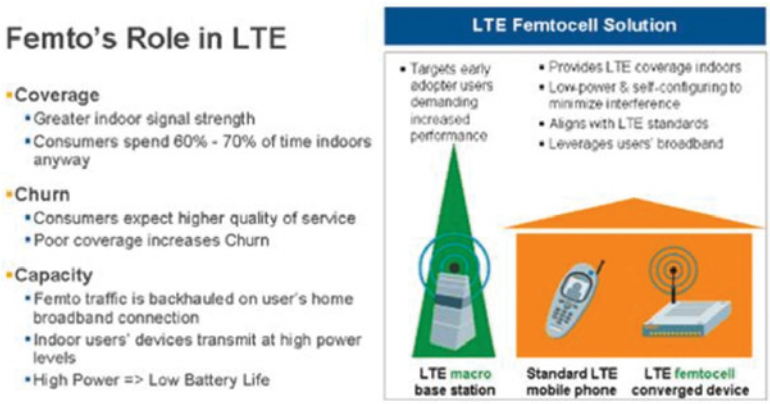


Figure 3. *Femtocells can play a critical role in operators' LTE deployments*

citywide and nationwide networks. The macrocell LTE buildout can come later – when demand volume justifies the investment. Until then, LTE femtocells will provide the flexibility, customer satisfaction, and return on investment needed to ensure carriers' success.

While these are still very early days for LTE, femtocells provide a compelling alternative to how operators build out their networks. Macrocell eNodeBs might just have to wait a bit longer before seeing the light of the day in the field; until then LTE femtocells will be soaking up the Sun.

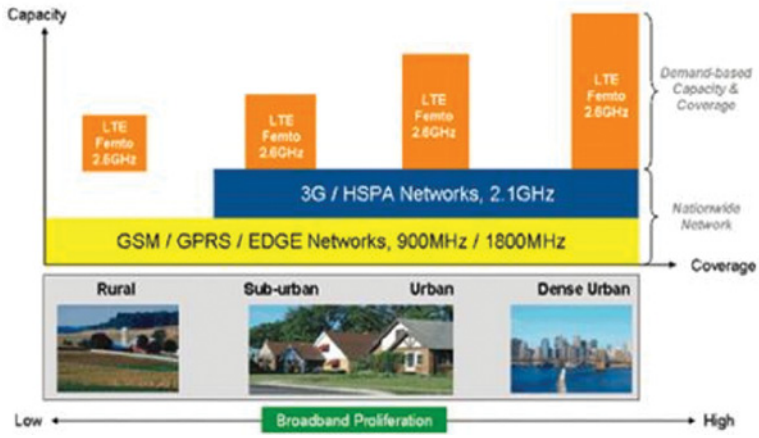


Figure 4. *Femtocells are an entirely new opportunity for efficient LTE deployment*

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Corporate Headquarters
5435 NE Dawson Creek Drive
Hillsboro, OR 97124 USA
503-615-1100 | Fax 503-615-1121
Toll-Free 800-950-0044
www.radisys.com | info@radisys.com

February 2010