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Demystifying 4G

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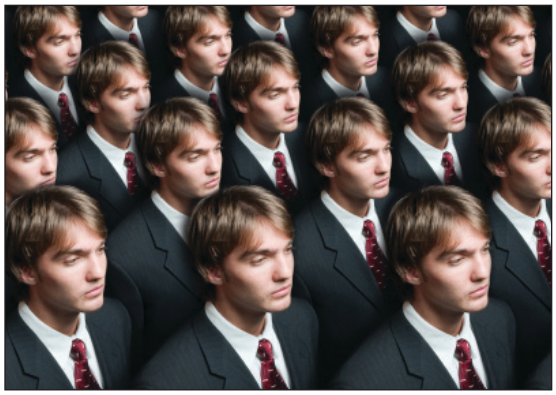

4G, the fourth generation of cellular standards, has promised to deliver broadband speeds into the hands of mobile users around the world. Technical stats aside, ask anyone on the street whether 4G is faster than 3G, and the numeral prefix alone guarantees their answer will be 4G. But how much faster? Let's do a thought experiment:

Think about the last time you tried to watch a video stream on your mobile device over your cellular network. Let me guess: jerky, pixelated, and lots of time spent pre-buffering? This is the experience that is typical for most users. Sometimes the buffering time alone for a 30-minute, low-quality video can reach five minutes. Now imagine downloading an entire 4-gig HD-quality movie to your cellphone in five minutes; or glitch-free live video conferencing a dinner date while simultaneously checking the internet for information about a restaurant and making a reservation. This is what is capable with network speeds of 100 Mbits/sec (Mbps)—the true definition of 4G by the International Telecommunications Union (ITU).

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But carriers report their maximum theoretical "4G" network speeds are anywhere from 20 Mbps to 50 Mbps, and real-world tests reveal drastically lower results. A cursory search on DSLReports.com or Speedtest.net shows that real-world speeds top out at about 10-12 Mbps, and often times are much lower. That means consumers are, at best, receiving 12% of the 4G experience as promised by the ITU definition. Even though ITU has permitted networks

whose evolution will reach the 4G standard to market themselves as 4G, labeling current next-gen networks "4G" is like calling a middle-school Little League pitcher a Cy Young candidate.

So who has 4G and what exactly is 4G? It's crucial to separate the technical as well as real-world definitions of 4G from the myriad marketing messages in order to have a complete understanding of next-gen networks. Let's start by taking a look at the technologies in the marketplace that float under the moniker "4G."

HSPA+:

HSPA+ stands for "Evolved High-Speed Packet Access." Unlike LTE and WiMAX, HSPA+ is a CDMA technology; it is the final evolution of 3G networks. Also unlike LTE and WiMAX, HSPA+ can natively communicate with legacy 3G networks. In many ways, HSPA+ is a stop-gap "4G" solution, because it requires less capital outlay than LTE and can immediately deliver much faster speeds to mobile users than 3G. It also means that current 3G devices can benefit from the faster HSPA+ network, a key difference that can't be understated.

In the U.S., both T-Mobile (who advertises as "America's Largest 4G Network"), and AT&T (who claims "America's Fastest Mobile Broadband Network") rely on HSPA+ technology, with T-Mobile routinely rating higher among consumers.

"Future iterations of LTE and Wi-MAX will become the first true 4G technologies."

HSPA+ speeds top out at about 21Mbps theoretically, and in the real-world hover between 8Mbs and 12Mbps. A real-world 8-12Mbps on HSPA+ networks represents a huge increase, enough for marketers to deem it fourth-generation. Adding fuel to their messaging, many users on HSPA+ networks get faster speeds than users on LTE and WiMAX networks. In fact, a recent multi-location test by Phonescoop.com revealed that T-Mobile's HSPA+ network, on average, was faster than Sprint's WiMAX network.

LTE:

The "3GPP Long Term Evolution" (LTE) standard was originally proposed by NTT DoCoMo in 2004 and represents a true departure from 3G technology. LTE is pre-4G if you will; the first step in a path to true 4G. The next step forward in LTE, LTE-Advanced, will meet the ITU speed definition.

In the United States, Verizon and MetroPCS have LTE networks, and AT&T and Sprint have also announced expansion or interest in this technology. Garnering

an additional nod, low-frequency (700 mhz) LTE has recently been endorsed by the U.S. for public safety and disaster recovery use.

Even though it's still new, LTE is all the buzz these days, making significant headlines at Mobile World Congress in Barcelona. Joss Gillet, Senior Analyst for Wireless Intelligence, outlined the global LTE roadmap:

"2011 marks the beginning of LTE rollouts worldwide… Europe will lead in terms of network deployments with 31 operators expected to commercially launch LTE by year-end, compared to nine in Asia Pacific and six in North America."

While the theoretical speed limit of LTE in its current incarnation is 50 Mbps, real-world tests say 12 Mbps is the real upper speed limit, and many users experience far slower speeds.

WiMAX:

WiMAX stands for "Worldwide Interoperability for Microwave Access." WiMAX boasts theoretical speeds up to 40 Mbps download, while real-world testing produces a more sobering 6-12 Mbps. Future iterations of WiMAX will meet the ITU definition of 4G, and have a theoretical downlink speed 28% higher than LTE-Advanced. Sprint/Clear uses WiMAX technology for its 4G network.

WiMAX has been around much longer than LTE, it costs significantly less to deploy than LTE, and enjoys greater popularity in developing countries where carriers have less capital outlay in legacy networks.

There are many WiMAX dongles and hubs on the market, however, there are significantly less WiMAX phones on the market vs. LTE, and these devices, in general, drive the market. John Kim, VP of Business Development at Alepo, explained the device dilemma: "Devices drive consumers, consumers want sleek and sexy devices, and there are more device manufacturers in the LTE space than there will be in WiMAX…so LTE will predominate, but WiMAX still has a place in the more price-conscious or emerging marketplaces."

Where is the Real 4G?

So we see that in actuality, none of the networks marketed as 4G are actually capable of delivering 4G

"Consumers want sexy devices on fast, reliable networks, no matter the "G" rating."

speeds as defined by ITU; in fact, in real-world, not theoretical situations, some so-called 4G networks don't deliver much beyond 3G speeds.

In terms of speed, networks currently marketed as "4G" are more precisely 3.5G. In terms of technological evolution, as we'll see below, ITU allows LTE and WiMAX networks to be labeled "4G" because they are not backwards compatible to 3G and their future iterations will meet the 4G standard.

Differences between 4G and 3G

Despite the confusion regarding 4G speeds, there are significant differences in the underlying technologies. The main difference in all iterations is that 4G radios use Orthogonal Frequency-Division Multiple Access (OFDMA) communication protocol instead of CDMA. OFDMA offers better interference management, increased spectral efficiency, increased number of users, and inherently less complexity. Another key difference is that 4G is an all-IP packet switched network, versus a combination of circuit-switching for voice and IP-packet switching for data.

There are many more differences between the two standards, but the above two make the two technologies incompatible. In other words, you need an LTE phone to work on an LTE network, and connecting and LTE or WiMAX phone to 3G networks requires a handover. This is significant, because that fancy new 4G phone may be spending as much or more time on a 3G network, at least in the year to come.

What 4G Means to Carriers

Certainly 4G is a marketing tool to attract and retain customers, but transitioning to 4G networks is also expensive, and requires additional back-end maneuvering to manage the hand-off between 4G and legacy networks. 4G means a significant capital outlay for carriers seeking to upgrade, new services that

exploit the faster network, real-time charging/billing to effectively monetize and manage data services, and an attractive 4G device portfolio to get the technology supported and in the hands of users. This last point is key, because all the speed in the world can't sell a network without devices that consumers want and that exploit the 4G technology employed.

We can look at device rollouts to glean some insight into carrier strategy. Until CES this year, neither Verizon nor AT&T had 4G handsets. The only U.S. carrier with a 4G handset was Sprint. The Verizon iPhone 4 is CDMA, not LTE (4G). And neither the iPad or the iPad2 will have 4G connectivity. Coupling this lack of 4G with the facts that selling iPads is like printing money, users are already dumping the original iPad in anticipation for iPad2, data services represent the most urgent need area in terms of network stress/support, and tablets are quickly becoming the preferred mobile data portal, it would seem the top carriers have a more realistic view of the rate of adoption of 4G than their marketing might suggest.

Network strategy also reveals a slightly different picture than the advertising. We can see many carriers who've chosen to use a mix of "4G" technologies for their networks—this despite the public vitriol about which tech is better. Deutsch Telekom recently announced HSPA+ to its 4G mix, AT&T is now announcing it will mix LTE and HSPA+ network resources, and Sprint, the U.S. bastion of WiMAX technology, announced at Mobile World Congress that it is "looking at trends and the migration track toward LTE." As Edward Kozel, CTO of Deutsch Telekom, explained, "The key feature of the 4G experience is that our customers will always automatically be able to use the fastest connection currently available…it won't matter whether this connection is based on Wi-Fi, LTE, or HSPA+"

What 4G Means for Consumers

For consumers, it's all about devices, network reliability, and perceived speeds—consumers want sexy devices on fast, consistently networks, no matter the "G" rating. A consistent 600% increase over 3G speeds is significantly perceptible, so for the time being, even HSPA+ will meet consumers' expectations.

A great example of this is AT&T's success even as its network quality suffered. In the United States, AT&T had the coolest device—the iPhone—for years, and despite consistently garnering the lowest scores for network quality, millions of users put up with it to have the iPhone.

Now that the iPhone is not locked to one carrier and new, hip smartphones drop almost daily, network reliability and quality will play a bigger role. This boils down to QoE, or more importantly perceived quality of experience in your area. As analyst Devin Coldewey wrote in MobileCrunch.com: "What matters is what's available and how fast it is, where you are."

Is 4G Just a Speed Limit?

So does attaching a theoretical speed limit badge to 4G even matter? Maybe not. With the flexibility ITU has given to carriers, just as HD can mean everything from 720p to 1080p (which has more than double the pixels per image of 720P), 4G can mean everything from HSPA+ to LTE to WiMAX.

Some analysts, like Dan Hays at PRTM, feel that the confusion around 4G will ultimately cause its demise. "The labeling of wireless broadband based on technical jargon is likely to fade away in 2011," said Hays. "That will be good news for the consumer. Comparing carriers based on their network coverage and speed will give them more facts to make more informed decisions."

If ITU can change the definition of 4G based on what operators are able to bring to market, and consumers perceive a faster experience on a reliable network as 4G, then maybe the designation doesn't mean as much as the talking heads.