

Research Paper: 4G Wireless Networks

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In terms of 3G, or third generation wireless networks, Sullivan (2011) emphasized about the beginnings of 3G networks that they have their roots in second-generation cellular voice networks. The 2G networks became 3G networks after carriers began using CDMA encoding technology to permit the delivery of Internet access. . . .Over time, CDMA encoding became more efficient and 3G networks began to deliver reasonably fast Internet access. Indeed, 2G networks evolved to 3G based on CDMA technology. In terms of how 4G is defined, Sullivan (2011) stated about the 4G network that the term 4G originally referred to a new generation of wireless network technology designed to deliver fast wireless broadband service to mobile devices. Whereas previous generation networks rely partly on older circuit-switched technology, the new networks are simpler.

In terms of the services and applications that are covered under the umbrella of 3G and 4G wireless network technologies, Sullivan (2011) highlighted in his article about the current state of 3G and 4G technology that [s]ome wireless carriers (Sprint and Verizon) have moved to build 4G networks from the ground up, But [*sic*] others- AT&T and T-Mobile- have chosen to soup up their existing 3G networks with advanced encoding technologies such as HSPA+. Indeed, Sullivan (2011) goes on to discuss the developments about 3G networks stating that [l]ate-stage 3G networks are indeed achieving network speeds comparable to those managed by the early-stage 4G WiMax and LTE networks of Sprint and Verizon. . . .The reality, however, is that even Sprint's and Verizon's networks aren't yet fast enough to satisfy the IEEE's definition of a 4G network. And although some networks are using different means to make their 3G networks run like 4G is intended to be (faster than 3G), data throughput differs as well.

In regards to the issue of how 4G LTE, 4G WiMAX, and WiBro differ, WiMAX

technology, considered a wireless technology categorized under 4G umbrella, supports very robust data throughput. The technology at theoretical maximums could support approximately 75 Mbps per channel (in a 20 MHz channel using 64QAM $\frac{3}{4}$ code rate). (“What is the actual throughput (data transfer rate) of WiMAX Technology?”, 2012) And according to Wimax.com, WiMAX is an acronym meaning "Worldwide Interoperability for Microwave Access." (What is the actual throughput (data transfer rate) of WiMAX Technology?”, 2012) In regards to what WiMAX was created for, WiMAX is a wireless digital communications system, also known as IEEE 802.16, that is intended for wireless "metropolitan area networks". (“What is WiMAX?”, 2012) In addition to WiMAX’s usage in Metroloitan areas, WiMAX can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. (“What is WiMAX?”, 2012)

In regards to the issue of backward compatibility with 3G networks for WiMAX and WiMAX2, for starters, it is known to be a backward compatible with 802.16e, known as the WiMax, set that is at present being used by operators all over the United States of America. (“Better Wimax – Wimax 2”, n.d.) Furthermore, WiMAX has many other benefits and advantages regarding its 4G based technology. The primary advantages of the WiMAX standard are to enable the adoption of advanced radio features in a uniform fashion and reduce costs for all of the radios made by companies. (“What is WiMAX?”, 2012) Thus, WiMAX serves a key purpose as part of the 4G umbrella of wireless technologies along with 4G LTE and WiBro. As for 4G WiBro technology and its performance for uploads and download speeds, WiBro is an abbreviation for Wireless Broadband. . . . HSDPA/HSUPA 3G networks had a maximum download speed of 14.4Mbps. But, 4G WiBro offers a maximum download speed of 40.32Mbps, roughly three times faster than the 3G WiBro. (“KT Goes Nationwide With WiBro”, 2011)

Although WiBro is a 4G wireless technology, much of the technological capability of WiMAX is relatively mature. In fact, the radio vendors who are members of the forum have deployed equipment in over 145 countries around the globe with trials and deployments exceeding 560. (“What is WiMax?”, 2012) Furthermore, in terms of the international reach of WiBro technology, the current 4G WiBro network that KT [technology company] has deployed nationwide in Korea features the world's best coverage of 85% of the total population. This surpasses the coverage in key advanced countries, such as the USA (36%) and Japan (70%). (“KT Goes Nationwide With WiBro”, 2011) In regards to how 4G LTE differs from WiMAX and WiBro technologies in terms of download speeds on the wireless network like AT&T, Sullivan stated in his article about how different phone companies integrate download speeds for different 3G and 4G technologies that AT&T's LTE network had the fastest download speeds of any 4G service. (2012) Sullivan also highlighted specifically in his article regarding AT&T's LTE technology and specific 4G transfer speeds that AT&T says 4G customers can expect download speeds of between 5 mbps and 12 mbps, and upload speeds of between 2 mbps and 5 mbps. (2012)

Because of the fact that the use of 3G technology will be slowly phasing out use for smart phone users as 4G wireless network technology becomes more integrated in many cities in the United States, Sullivan highlighted in his article, “Which Network is Fastest?” that based on a study of wireless technology for different telephone companies, AT&T's ace in the hole is its compelling pairing of 4G LTE service and 3G-equivalent HSPA+ service, which turned out to be the fastest combination from any carrier in our study. In more test data highlighted in Sullivan's article regarding 4G LTE technology and the performance of this technology by different phone carriers, Verizon's 4G was the first LTE service to reach the market; and in this year's tests it

showed that it has lost little or no speed since launching in December 2010, averaging 7.35 mbps for downloads and 5.86 mbps for uploads in our 13 test cities. (2012) Although Verizon was the first to bring LTE to market, Sullivan highlighted the fact based on their case study that the results suggest that Verizon's combination of 3G CDMA and 4G LTE service isn't as compelling today as AT&T's combination of 3G HSPA+ and 4G LTE technology. Verizon's LTE is slower than AT&T's for downloads. (2012)

Indeed, the competition among telephone carriers like AT&T, Verizon, T-Mobile and Sprint is fierce especially when the future sales implications of getting the consumer to choose one carrier based on great 4G service is large. In terms of which company got the fierce 4G LTE competition going, Phil Goldstein emphasized in his article on FierceWireless.com that Verizon Wireless threw down the gauntlet against its largest competitors in a new video marketing its LTE network, arguing that its LTE network is by far faster than other 4G networks from AT&T Mobility. (2012) Goldstein elaborates further on Verizon's attempt to promote their 4G LTE service over everyone else's by highlighting the fact that [i]n a video posted on its website, dubbed the "Ultimate 4G Throw Down," Verizon goes across the country and compares smartphones using its LTE network to those of other carriers using next-generation networks. (2012)

As far as Verizon's fierce competition with the other carrier's go in terms of competing communication speeds and coverage rates, Verizon has said its LTE network delivers average downlink speeds of 5-12 Mbps and uplink speeds of 2-4 Mbps. AT&T has said its LTE network, which covers around 74 million POPs, also delivers those kinds of speeds. (Goldstein, 2012) In terms of how other carriers like T-Mobile and Sprint responded to Verizon throwing down the "competitive LTE gauntlet," Goldstein mentioned about Sprint's rebuttal to Verizon's claims

that Sprint CFO Joe Euteneuer said at an investor conference . . . that Sprint's LTE network, which will be launched by mid-year, will be about as fast as the LTE networks of Verizon and AT&T. (2012) As for T-Mobile's rebuttal to Verizon's claims that they have more LTE coverage than all other networks combined, T-Mobile has said its HSPA+ network, particularly its faster HSPA+ 42 network, which covers 184 million POPs, delivers LTE-like speeds. T-Mobile plans to deploy LTE next year. Thus, at this point, only AT&T and Verizon can tout that they have real 4G LTE up and running as T-Mobile and Sprint continue plans to implement 4G LTE in the future.

However, one could argue that the key factor that should be noted regarding the question of why competition is so fierce among 4G LTE carriers is because, as author Louis Frenzel stated, LTE is the preferred wireless technology. Virtually all cellular systems ultimately will use LTE, and most broadband wireless access will be LTE. (2012) And at some point, all of the big carriers will have 4 G LTE implemented and carrier coverage as close to being equal. The issue of how the fierce competition among the big carriers who tout real 4G LTE technology will actually benefit the consumer involves more than just the carriers themselves. In fact, lawmakers like Rep. Anna Eschoo (D-Calif.) introduced the legislation, the "Next Generation Wireless Disclosure Act," to "ensure that consumers have complete and accurate information about the speed of 4G service before committing to a plan." (Goldstein, 2011)

This extra safeguard put in place by lawmakers will ensure that the 4G technology that the carriers tout is true when it comes to banking a sale based on subscribers' perceptions. Indeed, Goldstein noted that [t]he legislation also requires the FCC to evaluate the speed and price of 4G wireless data service provided by the top ten U.S. wireless carriers so that consumers can compare the various services. Whether the technology the carrier touts is 4G LTE, 4G

WiMax, 4G WiBro or another combination of technologies proclaimed to be covered under the umbrella of 4G, the consumers will ultimately benefit based on Eschoo's legislation. And [b]y introducing the legislation, Eschoo is wading into the contentious debate over how wireless carriers market their next-generation wireless services. (Goldstein, 2011)

The fact that carriers like Verizon and AT&T have the edge in terms of the advancement in 4G LTE for wireless networks compared to T-Mobile and Sprint at this point, Verizon and AT&T have changed their marketing tactic for gaining new sales based on their focus on promoting their coverage of the 4G LTE, not just upload and download speeds. Indeed, in terms of coverage for 4G LTE, Goldstein quipped about AT&T's statements about their coverage regarding 4G LTE that AT&T's LTE network covers 74 million POPs in 28 markets. (2012) In terms of total coverage for 4G technology by AT&T, Goldstein goes on to comment that AT&T said on its website that its 4G networks cover more than 200 million POPs. (2012) In regards to Verizon's coverage for 4G LTE, Goldstein mentioned in his article that a Verizon spokesman declined to comment, but [the Verizon spokesman] noted that Verizon's LTE network now covers 196 markets and more than 200 million POPs. (2012). As for why Verizon is able to cover more markets for 4G LTE than AT&T, the CEO of Sprint, Dan Hesse seemed to have the best insight on this issue. Indeed, author Cheng stated about Verizon's large 4G LTE coverage that Verizon Wireless got fat off the customers that left Sprint Nextel's iDEN network over the past few years. (2012) Cheng goes on to highlight about Verizon's takeover of Sprint's business as Nextel's service was failing that according to Sprint CEO Hesse, Verizon has nabbed half of the customers who left the ailing Nextel service over the past few years. (2012)

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