

3G and 4G Deployment is Ongoing — but Not as Fast as Advertised

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You have seen the ads on television and in print. Verizon, AT&T, Sprint and many smaller providers all claiming to have widespread high-capacity wireless coverage. If you live in a major metropolitan area, or a thriving mid-size city, you will have access to multiple providers' 3G service, but as you move away from these large-market areas, service declines—although construction of upgraded networks continues at a rapid pace.

We all understand that advertising is intended to create interest in new technologies and services, and will appear ahead of those services' availability. The good news is that 3G wireless service is catching up with the promises of the ads, but the bad news is that a whole new generation of smart phones and advanced wireless services has created additional demands on the networks.

System capacity is already being tested in some areas, with several consumer news outlets reporting lower-than-advertised data rates due to system loading. *PC World* and *Wired* both conducted surveys of upload speed, download speed and reliability, with similar results. They report good download speed in most markets, with results ranging from 500 kbps to 1.4 Gbps, with most in the 600-800 kbps range. (The maximum 3G speed is as high as 3 Gbps, in short bursts, depending on the transmission technology used by that network.)

In these surveys, service reliability showed greater variation, revealing providers' weaknesses in some markets. Reliability as low as 80% was reported, meaning that many customers experience dropped connections and times of very low data throughput. It appears that the wireless companies must simultaneously expand 3G service into unserved areas, while increasing capacity in larger markets.

As background, Table 1 lists the technologies used in the U.S for 3G, 4G and planned future upgrades. Although major wireless providers Verizon and AT&T are heavily promoting 3G to build a customer base with increased network usage (and revenues), they and smaller providers are looking ahead to the next generation, mostly using the technologies listed as "Near-4G" in Table 1.

The Status of 4G

With that introduction, let's start with the most advanced systems, 4G, which began deployment in 2009. To date, the only 4G providers are Sprint and the Sprint/Clearwire Clear service. Both use the same

Modulation	3G	Near-4G	4G
TDMA	EDGE	EDGE Evolution	
CDMA	EV-DO	UMB	
	HSPA	LTE	LTE Advanced
OFDMA			WiMAX (802.16)

Table 1 · Summary of the most common 3G and 4G technologies deployed—and planned—in the U.S.

WiMAX network under a partnership agreement, using the 2.5 GHz spectrum. Each has its own backhaul and network management. WiMAX 4G service is advertised as providing 3 to 6 Gbps download speeds.

Table 2 is a list of cities with Sprint 4G coverage. The company has an aggressive plan for expansion in 2010, which should keep it ahead of competitors in the near future. We also can expect to see new handheld devices that take advantage of the big increase in speed versus 3G.

<p>Currently Operating</p> <p>Maui Honolulu Seattle San Antonio Austin Greensboro, Winston-Salem and High Point Raleigh, Durham, Chapel Hill and Cary Charlotte Dallas-Ft. Worth Chicago Philadelphia Milledgeville Salem Corpus Christi Wichita Falls Waco Midland-Odessa Lubbock Killeen-Temple Abilene Amarillo</p>	<p>Bellingham Boise Las Vegas Portland Atlanta Baltimore</p> <p>Planned for 2010</p> <p>Cincinnati Cleveland Los Angeles Miami Pittsburgh Salt Lake City St. Louis Boston Denver Kansas City Houston Minneapolis New York San Francisco Washington, D.C.</p>
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Table 2 · Sprint's 4G coverage locations, as reported on the Sprint web site in late April, 2010.

Other wireless carriers have been quieter about promotion of their 4G upgrades, presumably to discourage prospective 3G customers from waiting. There is some argument whether the proposed technologies are “true” 4G (definitions vary), which is why some are listed in Table 1 as Near-4G. For purposes other than marketing and advertising, this is unimportant. The giant step upward in data rate will be evident to consumers when these technologies are implemented.

3G Notes

Even as 4G systems are beginning, 3G continues to be added where there is unserved population and where additional capacity is required.

A significant issue at this time is backhaul capacity. Upgrades to base stations have required corresponding upgrades to the links between the cell sites and central switching hubs. Both fiber and microwave transmission are being used—one piece of evidence that a site has been upgraded is the appear-

ance of additional dishes for the backhaul link, or new trenches that have been dug to lay fiber optic cable. The new backhaul capacity must be sufficient for 4G as well.

Although a new generation of smart phones is creating demand for 3G services, the “market ceiling” is still unknown. As more services appear, the consumer cost is increased—through more costly devices, payments for new “apps” that are enabled by 3G speeds, as well as the cost of the service itself. Carriers offer plans based on gigabytes instead of minutes, which may mitigate the cost increases for customers needing voice-only or only occasional high-speed services.

3G/4G News Briefs

On April 28, *HP* announced that it would buy *Palm, Inc.*, a provider of smartphones powered by the Palm webOS mobile operating system, at a price of \$5.70 per share of Palm common stock in cash a value of approximately \$1.2 billion. The transaction has been approved by the HP and Palm boards of directors. With this acquisition, HP has the technology to enter the smartphone business, following the lead of Apple’s iPhone. Analysts suggest that HP’s size and global presence offer significant potential to become a market leader, although the market is highly competitive.

The new *Apple iPad 3G*, which adds AT&T connectivity to the WiFi that was included in the original model, is said to have 5 antennas arranged around the LCD screen frame. There are two each for 3G and WiFi, providing diversity and possible future MIMO capability, plus one for GPS. Speculation is that Bluetooth and high-speed wireless peripheral connectivity will add even more radio content to the iPad platform.

EJL Wireless Research predicts that LTE (and its enhancements) will become the dominant transmission technology by 2013, perhaps sooner. Other analysts have made similar observations.

Sprint and *HTC Corporation* have announced summer availability of the first 3G/4G Android handset, HTC EVO 4G, offered exclusively by Sprint. EVO is the first WiMAX-based smartphone. Customers will be able to purchase HTC EVO 4G through all Sprint channels and through national retail part-

ners, RadioShack, Best Buy and Walmart, this summer. Pricing will be announced at a later date. A formal introduction is expected in late May or early June.

Internet-based telephone service such as *Vonage* and *Magic Jack* are becoming more widely used in portable applications, as WiFi access continues to expand. This trend gives customers a lower-cost option, or at least reduces the number of minutes used on a wireless plan.

Time Warner and *Comcast* are expanding their recently-introduced 4G access plans, which use the *Clear* WiMAX network. Emphasis appears to be on business customers. Each company now has wireless access plans with WiFi and/or 3G connections under agreement with established wireless providers.

Mobile television reception capability is finally starting to show up among early adopters of devices supporting the technology. While few wireless devices have built-in TV tuners, the new *Hollywood* chip from *TI* may accelerate the trend. Internet TV apps on smartphones are expanding, and TV networks are anxiously waiting to see how consumers respond to the possibility of anywhere-TV.

Several wireless companies are beginning to market communications hub devices that provide a bridge between 3G/4G wireless service and the user's home Internet connection (such as *AT&T's* microcell). While most commentary has been about the ability of a home interface to reduce the load on 3G cell sites by transferring it to a local Internet connection, it also enables a user to have a home network that accesses the Internet via the wireless network, as is now done for portable computing. For many customers, this will be the final step before cutting off landline telephone service. Similar products are available to extend Sprint and Clear 4G service, creating a local WiFi hotspot that can be used by any WiFi-enabled device.

What About 5G?

5G has different definitions, but is generally considered to be the "one network" that utilizes all communications connections, managing them under a single provider contract. Key elements

required for 5G include an operating system that can effectively manage multiple paths—local DSL, CATV or fiber, 4G wireless network, public hotspot, etc. Voice, data and audio/video entertainment would be available anywhere with 5G. Other technical challenges include usage monitoring (billing), dynamic bandwidth allocation to conserve wireless spectrum, and hardware interoperability standards.

This type of interconnected system is envisioned in the FCC's recent statement presenting objectives for the U.S. national broadband initiative. The FCC foresees a nation that is fully electronically connected, as a logical "next step" after mail, telegraph, telephone, broadcasting, wireless phone service, and now wired and wireless broadband access. It will be interesting to see how this plan develops.