

## Wireless Spectrum Doomsday Looms

For now, tiered plans are keeping carrier networks from melting down. But demand for mobile broadband means the current system is unsustainable.

By Peter Rysavy, [InformationWeek](#)

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People desperately want bigger, better, faster smartphones. In Beijing last week, frustrated would-be owners [threw eggs at the Apple store because they couldn't get iPhones](#). Hundreds of thousands of applications, voice interaction, social networking on the go, video-enabled applications, multimegabit data throughput rates, and dazzling displays are making mobile broadband one of the most dynamic, exciting, job-creating, and transformational industries ever created.

Too bad it's about to go over a cliff for lack of spectrum.

Radio spectrum, the core enabler for mobile broadband, translates directly to the number of bits per second available to each user. Demand for those bits keeps going up as devices become more powerful and capable. According to a recent [report by Arieso](#), iPhone 4S users consume twice as much data as iPhone 4 users and three times as much data as iPhone 3G users. Sharper displays are one reason--the hot new Android-powered Nexus Galaxy has a display with 720 by 1,280 pixels, not that different from a laptop display. Video at this resolution, even using the best-available encoding technology, such as H.264, can exceed 3 million bits per second. Yep, you read that right: 3 Mb per *second*, comparable to what a Netflix user in a higher-quality viewing mode might consume.

What's wrong with this picture? Nothing if you're the user--it's beautiful. But for operators, it's a horror movie. Consider that a voice call takes about 10,000 bits per second. That high-quality video stream is consuming hundreds of times the capacity of a voice call. The math is simple. The most efficient wireless technology ever developed, 4G LTE, has sector capacity (imagine three city blocks in a downtown area with more than 1,000 subscribers) of 14 Mbps on the downlink. Just five demanding users can consume an entire sector capacity block.

It's no wonder operators are scrambling. Witness AT&T's failed bid to merge with T-Mobile to achieve greater efficiency in spectrum assets, Verizon's attempt to gobble up spectrum owned by the cable companies, or Sprint trying to work with LightSquared to obtain additional capacity for its new LTE network.

This is why unlimited data plans have largely fallen by the wayside. Replacing them are tiered plans that, in round numbers, cost about \$10 per gigabyte. Operators intend this pricing level to permit reasonable use of the network but discourage excessive or abusive use. That's working for the moment, but I don't believe it's a sustainable model. Current smartphone plans allow almost any amount of email and browsing of typical Web pages, and users can easily consume the monthly plan in a matter of days. See for yourself. Go to Verizon's

[data-usage calculator](#) and plug in values. Want to stream two hours of music a day? Oops, you've consumed 3.52 GB of data in a month, exceeding the typical 2-GB monthly plan for smartphones. How about 30 minutes of video streaming per day, not unreasonable for a salesperson demonstrating a new product? That's 5.13 GB per month. Going back to that Galaxy Nexus at 3 Mbps, now you're consuming data at 1.35 GB per hour. That 2-GB plan is gone in 89 minutes. That's just one movie or extended high-quality videoconference.

New technologies such as 4G LTE deliver amazing throughput rates, but the problem is that they allow users to consume data just that much faster. IT needs to understand that these limits apply just as much to business applications, especially if it embeds video, whether for telemedicine, field service, collaboration, videoconferencing, or training.

You can't blame the operators. Pricing is their best (and practically only) tool for managing network congestion created by a growing percentage of very heavy data users. Even so, in real terms, pricing is on the decline. Ten dollars per gigabyte is 10,000 times cheaper than the first packet IP networks, such as Cellular Digital Packet Data, for which usage-based pricing was 10 cents per kilobyte (\$100,000 per gigabyte) in the mid 1990s. This is not the point, however. The point is that broadband use is growing faster than capacity. Capacity is a function of technology and spectrum, and as quickly as technology is improving, our ability to extract more capacity from spectrum is reaching the theoretical limits of physics. Thus, more spectrum must also be part of the equation.

The Federal Communications Commission in its 2010 National Broadband Plan projected that the industry will need an additional 300 MHz in the next four years (above the existing total 500 MHz spectrum base), growing to a total additional amount of 500 MHz in the next 10 years. Are we on track to deliver this amount of spectrum? Not even close. For a multitude of reasons, including politics and massive resistance by affected parties, efforts to free up spectrum via, for example, incentive auctions that might transfer spectrum from the broadcast industry to the mobile industry are moving at a glacial pace.

This is one reason operators are trying to take matters into their own hands, but there is no easy answer. Technologies such as LTE will get better over time, through new versions. For example, LTE-Advanced has innovations such as heterogeneous networks, enabling femtocells and picocells to seamlessly blend with the macro network, thus increasing capacity. But that is a decade-long effort due to immense complexity and dependence on standards that haven't even been finished yet. Right now, we absolutely must have more spectrum. Without it, the industry will stall. Tiered pricing is not really a solution, it just slightly delays the inevitable. If people can't do what they want to do at rates they can afford, they'll spend their money elsewhere.

The bottom line for IT is to set realistic expectations for throughput and capacity. In the absence of new spectrum, networks will be congested at times--slower, with higher latency. As I discuss in [my recent report on 3G/4G and Wi-Fi convergence](#), judiciously off-load onto Wi-Fi whenever and wherever it makes sense. Longer term, technologists need to be unanimous in supporting efforts to speed the political process toward a swift and sustainable spectrum-allocation process. Without more clean spectrum resources, innovation and growth will suffer.

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