FierceWireless

Topics: Network Infrastructure

Rysavy: Threading the spectrum needle - can LTE and Wi-Fi coexist?

February 16, 2016 | By Peter Rysavy

INDUSTRYVOICES

Peter Rysavy

Two global wireless technology juggernauts are about to play in the same yard and how they behave with each other will shape the future of mobile broadband for decades to come. The cellular industry, responding to huge consumer demands, needs to increase network capacity, and operating LTE in unlicensed spectrum bands will provide a huge boost. But Wi-Fi uses these same spectrum bands. Can these two technologies co-exist?

The problem is challenging because LTE and Wi-Fi have different mechanisms for controlling how devices access the radio medium. In LTE, the base station manages all communication, granting permission to mobile devices to communicate. In contrast, any Wi-Fi station can initiate communication so long as it uses a listen-before-talk (LBT) mechanism in combination with random backoff intervals so two stations waiting to talk don't begin talking at the same time. So far, this method has operated well, allowing Wi-Fi networks to co-exist with each other, sharing available capacity, even in dense, overlapping deployments.

Some operators are pursuing an LTE solution for unlicensed bands called LTE-U, which others are pursuing a different version called LTE-Licensed Assisted Access (LTE-LAA), being developed through an international standards-setting process. LTE-U, available now, does not implement LBT, but LTE-LAA, still being developed, does. LTE-LAA might enable better co-existence, but that engineering fact is still being tested. Bluetooth and Wi-Fi, completely different technologies with different radio characteristics co-exist well in the same bands, so LTE co-existing with Wi-Fi holds great promise. Recent testing by Signals Research Group, for instance, concluded that "Introducing LTE-U into a primary channel or a secondary channel that is already occupied by Wi-Fi is largely comparable to introducing another Wi-Fi AP into the channel."

The outcome of this co-existence work will have huge consequences. Cellular operators today use Wi-Fi for offload and most smartphones can operate in either Wi-Fi or LTE mode. Despite various 3GPP specifications that integrate Wi-Fi and LTE operation, being able to use the same LTE access technology in both cellular and unlicensed bands promises to provide a better user experience. In addition, the final LTE-U and LTE-LAA mechanisms will almost definitely become the foundation of licensed/unlicensed operation in 5G standards. Finally, harnessing unlicensed spectrum for greater capacity will improve the economics of small-cell deployments. In LTE-U, the unlicensed channel, used on the downlink, can provide 20 MHz, and eventually 40 MHz of extra capacity.

So far the FCC has refrained from mandating a technical co-existence solution, giving engineers time to develop an optimal solution based on engineering principles rather than politics. Current efforts by Wi-Fi and cellular equipment vendors, including co-existence testing and protocol refinements, are encouraging

and the best means forward. The FCC stated in a recent blog on LTE-U, "Throughout this process, the Commission has closely monitored developments and actively encouraged all stakeholders to work together to find common ground." The FCC has just granted a special temporary authority (STA) to Qualcomm for evaluation tests at two Verizon sites. The Wi-Fi Alliance is also working with LTE-U advocates on co-existence test plans.

Getting Wi-Fi and LTE to play together is an example of the inherent challenge of spectrum sharing among disparate systems. Another example is highlighted by the FCC's approach to making the 3.5 GHz band useable for mobile broadband. To make existing government systems, cellular systems, and unlicensed systems co-exist at 3.5 GHz, a complex, database-driven Spectrum Access System (SAS) will arbitrate access. The President's Council of Advisors on Science and Technology advocated spectrum sharing as the new norm for spectrum use. In situations where an incumbent makes light use of a band, sharing provides obvious benefits. But making disparate systems co-exist will always be complex. The most complicated part of multi-user radio systems work is the medium-access control mechanisms, challenging enough when just one system occupies a band. Two or more systems escalates the challenge.

Successful co-existence in unlicensed bands will take work and determination. A couple of decades ago, skeptics said CDMA was too complex to work on a wide scale. But CDMA persevered, becoming the backbone of global 3G systems. Similarly, over time, technologists will solve spectrum sharing challenges, including threading the needle for harmonious LTE and Wi-Fi co-existence.

Peter Rysavy is president of Rysavy Research, a consulting firm that has specialized in wireless technology for more than 20 years. More at http://www.rysavy.com.