New Wi-Fi Network Rides Unused TV Airwaves

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Microsoft researchers are working on a Wi-Fi network that will take advantage of unused TV-broadcast frequencies. Credit: Moritz Wanke on Flickr

Nestled between airwaves owned by U.S. TV stations are slices of unused, un-owned broadcasting frequencies—and a new project by Microsoft hopes to use that space to deliver more-efficient, faster wireless Internet. But the project comes at a time of uncertainty about who, if anyone, will ultimately own these free frequencies. The future of this and similar innovations depends on pending legislation that Federal Communications Commission Chairman Julius Genachowski discussed at this year's Consumer Electronics Show.

MIT's Technology Review first reported on the Microsoft project earlier this month. The research team will publish about it in the spring, said lead scientist Krishna Chintalapudi of Microsoft Research India, in Bangalore.

The new network sends and receives information over so-called "white spaces" in the electromagnetic spectrum that are adjacent to frequencies owned by television stations. Originally, the FCC didn't allow other devices to transmit in white spaces, but it ruled in 2008 that it would open up white sppaces for other users. They'll be testing white space use starting Jan. 26 in Wilmington, N.C.

One signal from many

A Wi-Fi signal now uses wide swaths of the spectrum, usually between 20 megahertz and 40 megahertz. But white space is scattered in narrow bands of 6 megahertz, located in between TV stations and wireless-microphone frequencies. "The key problem in white spaces is that it's fragmented," Chintalapudi told InnovationNewsDaily.

"So instead of using one big chunk of spectrum, there's a question of how we stitch together these small slices," explained Edward Knightly, an electrical and computer engineer at Rice University in Houston, Tex. Knightly has created and tested his own Wi-Fi network, using white spaces, in a Houston neighborhood where many residents can't afford fast Internet access.

Chintalapudi's team solved the fragmentation problem by creating what he calls a "compound radio" that's comprised of many smaller "radiolets." Each radiolet independently sends and receives data over narrow parts of the spectrum.

Faster, farther, plays better with others

Together, the radiolets cover more spectrum than the Wi-Fi people use in coffeeshops and at home today. Thus it's "much faster" than current Wi-Fi, Knightly said. Of course, any other Internet connection that uses the same amount of spectrum would be just as fast, so in the future the new network wouldn't necessarily be faster than its contemporaries. The radiolet system is more cost-effective, however, than a connection that uses a wide, continuous band, Knightly said.

Because it uses TV frequencies, the network's signals should travel farther. "The big advantage in [Wi-Fi that uses white space] is the extended range," Knightly said. Other research has found white space Wi-Fi transmits three to five times farther than conventional Wi-Fi in an urban environment, Chintalapudi said.

The network should work better around other wireless devices. It shares airwaves better than traditional Wi-Fi because it can use these smaller portions of the spectrum, Chintalapudi said.

When the FCC first opened up TV white space, broadcasting networks worried that other devices would interfere with their own transmissions. White-space users might also interfere with wireless microphones, such as those used during concerts. Chintalapudi's compound radio minimizes interference by checking a database of free white space, then choosing narrow frequencies that have the least interference.

An uncertain future

What's standing in the way of white-space Wi-Fi going to market? Not research advancements, according to Chintalapudi and Knightly. “The design is almost there,” Chintalapudi said. "There's nothing significant left."

The next step is getting companies to manufacture white-space technology, but that depends in part on what the FCC will do with white space. Analysts aren't sure if the FCC will keep white space free and unlicensed, as it is now, or if the commission will auction off white space so that it's all privately owned. "Because of the political uncertainty, the market is in limbo, companies can't commit," Knightly said.

The FCC believes in providing both licensed and unlicensed former TV bands, but can't predict how much of the spectrum will go toward each, a senior FCC official told InnovationNewsDaily. The commission is pushing for legislation that will encourage TV stations to sell some of the spectrum they still own, but don't use, at a commission-run auction. That will free more spectrum for other users, but the FCC can't be sure how much will be freed in different cities, the official said.

Knightly worries that if all white space is licensed, white-space Wi-Fi will never become commercialized. He

compared white-space Wi-Fi's situation to the original development of Wi-Fi in the 1990s, when the technology sprang up in unlicensed airwaves outside of the TV spectrum. That free space helped keep innovation cheap and available.

"All the Wi-Fi we have today would never have existed if we had to wait for a company to buy it and deploy it," he said. "It grew as a grassroots effort."

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