Rice University Tests WiFi Over Active TV Channels

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Rice University engineers have demonstrated the first system that allows wireless data transmissions over UHF channels during active TV broadcasts. If this technology is incorporated into next-generation TVs or smart remotes, it could significantly expand the reach of so-called “super Wi-Fi” networks in urban areas.

Edward Knightly, a professor and department chair of electrical and computer engineering and director of the Rice Wireless Network Group, said the UHF spectrum, which ranges from 400 to 700 MHz, is often called the “beachfront property” of the wireless spectrum. Unlike the higher frequency signals used for existing Wi-Fi hotspots (2.4 GHz and 5 GHz), UHF signals carry for miles and are not blocked by walls or trees. Because of these advantages, wireless data hotspots that use UHF are often referred to as “super Wi-Fi.”

In the United States, TV broadcasters have been given preferential access to the UHF spectrum for more than 50 years. If no TV broadcaster has laid claim to a UHF channel, the FCC allows secondary users to transmit wireless data on that channel, provided that the transmissions do not interfere with TV broadcasts in any part of the UHF spectrum. The rules governing this secondary access are often referred to as “TV white space” i.e blank portions of the TV spectrum. Though most of the UHF band is already taken in US cities, it is largely underutilized. According to a 2014 report by the TV rating company Nielsen, fewer than 10 percent of US. households rely on over-the-air broadcasts for TV programming.

To demonstrate that wireless service providers could make use of the UHF spectrum without interfering with TV broadcasters, Knightly and Rice graduate student Xu Zhang developed a technology called “Wi-Fi in Active TV Channels,” or WATCH, and received FCC approval to test it on the Rice campus in 2014. WATCH transmits data over UHF without interfering with TV broadcasts. With WATCH in use, Knightly said it took a fraction of a second longer than normal to tune in to a UHF TV broadcast on the test television. While the increment could be measured — it was less than a 5 percent increase.

WATCH requires no coordination with or changes to legacy TV transmitters. Instead, TV signals are broadcast as normal and the WATCH system actively monitors whenever a nearby TV is tuned to a channel to avoid interfering with reception. The technology to allow this comes in two parts. One aspect of WATCH monitors TV broadcasts on a channel and uses sophisticated signal-canceling techniques to insert wireless data transmissions into the same channel; that eliminates TV broadcasts from interfering with the super Wi-Fi data signals being sent to computer users.

The other aspect of WATCH is dedicated to making certain that data transmissions do not interfere with TV reception; this part of the technology would require TVs to report when they are being tuned to a UHF channel. In practice, this could be accomplished with either smart TV remotes or next-generation TV sets. In the tests at Rice University, Zhang constructed a “smart-remote” app that reported whenever a test television in the lab was tuned to a UHF channel. When that happened, the WATCH system automatically shifted its data transmissions to another part of the UHF spectrum that wasn’t being used.

Zhang and Knightly’s report on the research, titled “WATCH: Wi-Fi in Active TV Channels” won best-paper honors last month at Association of Computing Machinery’s MobiHoc 2015 conference in Hangzhou, China. Knightly said technology like WATCH will become increasingly important as the demand for wireless data services increases and the number of broadcast TV viewers decreases.

To learn more about the Technology you can download the Paper -WATCH: WiFi in Active TV Channels.

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