

Rethinking 4.9 GHz Broadband

With the advent of 700 MHz broadband on the horizon, the public-safety community is in a position to take stock and rethink its use of the 50 megahertz of spectrum at 4.9 GHz granted by the FCC in 2002. For the last three and a half years, public safety has been defining its requirements for 4.9 GHz broadband and dovetailing with the Project 25 (P25) interface committee's broadband task group. This public-safety/industry effort compares public safety's requirements



with the two technologies being proposed for the band: IEEE 802.11-2007 and 802.16e-2005.

Public safety's intention at the start of the

requirements development effort was to select a single technology for public safety to use in the band, reducing potential interference and achieving interoperability along the way. Since that time, the concept of a nationwide broadband network for public safety at 700 MHz has gathered momentum, with the auction beginning in January. This potential nationwide broadband system at 700 MHz may put public safety in a position to develop new uses for 4.9 GHz broadband.

One use for the 4.9 GHz spectrum is point-to-point backhaul for existing LMR fixed sites. Given that the spectrum is only licensable to public safety, licensees would be provided with a cheaper — and better performing — alternative to other microwave backhaul solutions. Another use of this spectrum is incident-area networking, a concept whereby public safety would deploy a localized 4.9 GHz broadband network at the scene of an incident through access points deployed at an incident scene by their

vehicles or other methods.

The first use, fixed point to point, may have a lesser need for standards-based implementations than incident-area networking. However, in a fixed point-to-point solution, the need for standards-based solutions grows with the increasing size of the backhaul network being built by an agency. Standards would enable an agency to build such a backhaul network using different vendor equipment while fostering competition.

With incident-area networking, a single standards-based solution is a necessity from the beginning to prevent interference problems and provide interoperability. Given that any public-safety agency can license and deploy solutions in the entire 50 megahertz of spectrum, it's possible that neighboring agencies could select systems that are incompatible with each other. For instance, if two neighboring agencies both deployed an incident-area network, one with IEEE 802.11-2007 and the other with IEEE 802.16e-2005 both using the same portion of the 4.9 GHz band,

Another use of this spectrum is incident-area networking, a concept whereby public safety would deploy a localized 4.9 GHz broadband network at the scene of an incident.

it's likely that the IEEE 802.11-2007 system would suffer from unintentional denial of service if the IEEE 802.16e-2005 system is transmitting. This is a side effect of the differences in the way the two standards implement access to the network.

The medium access control method of IEEE 802.11-2007 uses carrier sense multiple access with collision avoidance (CSMA/CA). This particular method, in simple terms, evaluates the spectrum to determine if it's already in use. If it detects that the spectrum is in use, it

will wait until the spectrum is clear to transmit. An IEEE 802.16e-2005 system uses a scheduling protocol, where the access point schedules all transmissions with the clients and doesn't evaluate the spectrum prior to transmission. Thus, if the IEEE 802.16e-2005 system is constantly transmitting its scheduled data, the IEEE 802.11-2007 system will never see that the spectrum is clear for it to transmit, rendering it ineffective.

This interference example provides a compelling reason to have one standard technology for the 4.9 GHz band; but the far simpler and more important reason is interoperability. In the absence of a 4.9 GHz broadband common-air interface (CAI), interoperability is unlikely, if not impossible. Some have proposed that the IP layer could provide interoperability between the two protocols, but again, given the physical layer issues described earlier, this is a weak argument.

These two primary deterrents to allowing both candidate protocols to be used in the 4.9 GHz band — inter-

ference and interoperability issues — provide motivation to finish the selection process. Additionally, many positive factors may contribute to the decision, such as competitive pricing, continued leverage of commercial innovation through the use of commercial-off-the-shelf products and the potential to tie the use of the 4.9 GHz spectrum to the 700 MHz broadband solution, where having one 4.9 GHz technology will more readily enable multimode devices for full broadband interoperability.

As of December, public safety

was closing in on a decision between the two protocols that have been proposed. In the P25 interface committee's broadband task group, the competing protocols have been evaluated in terms of the user requirements drafted by the Project 34 user needs committee. The user requirements cover topics such as quality of service (QoS), the ability to operate in the absence of infrastructure, network performance, security and additional salient areas. The manufacturers that proposed the original protocols have provided substantiations for their given protocols and the requirements in question to provide a means to compare and contrast the two protocols and decide which better meets the user requirement. In addition, scenarios from the public safety statement of requirements developed through Safecom have been used — via simulation — to compare the performance of the two

protocols given a residential house fire, a law-enforcement traffic stop, a heart attack in a residence and a chemical plant fire.

In an upcoming meeting, the Project 34 user needs committee will prioritize and weigh their requirements. This begins a formal decision analysis process where, through a structured and unbiased method, a selection can be made between IEEE 802.11-2007 and IEEE 802.16e-2005. As part of this process, a second evaluation of public safety's requirements will be necessary now that the 700 MHz broadband system for public safety is gathering momentum. It's likely that some of the requirements for 4.9 GHz broadband will change, whether through addition of new requirements or obsolescence of others.

The public-safety community is moving into a unique position where it will have the ability to leverage 50

megahertz of licensed spectrum at 4.9 GHz along with 20 megahertz of spectrum at 700 MHz for broadband communications. The opportunity for innovative solutions has never been greater, and public safety is in a good position to take advantage of the opportunities. ■

Andrew Thiessen is the systems research and architecture development team leader for the Institute for Telecommunication Sciences (ITS) in the National Telecommunications and Information Administration (NTIA) in the Department of Commerce. Thiessen is the chair of the Project 25 interface committee broadband working group and co-chair of the National Public Safety Telecommunications Council (NPSTC) broadband standards working group. The views, opinions and findings in this article do not represent an official position by the NTIA or the Department of Commerce. E-mail comments to editor@RRMediaGroup.com.