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Opinion

Wireless Broadband's Dirty Little Secret

BY MARK SUTER

The concept of using outdoor 802.11 for mobile public safety networks could be headed for the "trough of disillusionment."

With all the hype surrounding broadband wireless, muni wireless and Wi-Fi, the wireless industry seems to be hoping that municipalities, public sector agencies and other potential customers will overlook one key fact: 802.11 was not designed for mobility or for outdoor deployments.

The ease with which people have become accustomed to using 802.11 in their homes, offices and coffee shops has misled people into believing it is an attractive option for public safety users or wireless service providers attempting to meet the demand for outdoor, metro-area broadband networks. However, to overcome the physical layer (PHY) limitations of the IEEE standard, these same cities, agencies and service providers are discovering that effective mobile outdoor environments require the saturation of an area with 802.11 devices, thereby obliterating the economics behind city-wide deployments.

In 802.11a/g/n/j, information is modulated using a technique known as OFDM, which, when appropriately configured, is well-suited to many wireless communications scenarios. However, conventional OFDM lives or dies by the relationship between cyclic prefix length and multipath delay spreads. Herein lies a critical problem for 802.11.

The 802.11 WLAN standard was designed for a very specific use case (such as indoors at pedestrian speed). As a result, the PHY design differs in critical ways from the requirements for a mobile wireless metro-area network PHY.

However, in wireless communication systems, multipath propagation due to reflections is a problem for radio design. The 802.11 standard was designed for low delay spread reflections (such as indoors), compared with outdoor propagation where delay spreads are an order of magnitude higher, and easily exceed the truncated 802.11 cyclic prefix length.

So, what does this mean? It's all about economics. In order for radio devices to be able to receive data with minimal packet loss, they require line-of-sight (LOS) with other devices. Thus, deployment of a mesh-style network across a metro-wide area using standard 802.11 translates into a device density approaching 40 nodes per square mile. No matter how you look at this – from capex, opex, site acquisition, deployment, management and/or maintenance perspectives – the economics become challenging.

Furthermore, while only pedestrian speeds, such as walking around an office, were contemplated for the standard, many public safety customers have unrealistic expectations that conventional 802.11 receivers will be able to operate in an urban environment at vehicular speeds, an expectation that few vendors have tried to dispel.

In other words and to steal a phrase from the Gartner Group, outdoor 802.11 as a technology for mobile public safety networks is approaching the "peak of inflated expectations." And as these networks are rolled out, it could be destined for the "trough of disillusionment."

The motivation for leveraging the 802.11 standard is clear. The industry wants to exploit the ubiquity, availability and low cost of 802.11-based silicon to address the market demand for outdoor, metro-area mobile broadband networks. This includes attempts to address the needs of customer segments like public safety and homeland security. In particular, in these markets, the deployment of 802.11-based technology for use in the licensed 4.9 GHz band is on several agendas and is receiving broad interest.

Several other standards have been proposed that specifically target outdoor deployment, including IEEE 802.16e and 802.20. However, equipment based on these standards is not yet available. As these are viewed as competitive technologies, with vendors such as Intel and Motorola supporting 802.16e while Qualcomm is lining up behind 802.20, the mobile wireless broadband standards battle is far from over.

Even with the 802.16e standard, there is not consensus across areas such as configuration (Samsung's WiBro or another variant), interoperability (mobile WiMAX's definition) or spectrum harmonization.

Time is not on the side of the public safety agency looking to the industry to deliver a mobile, broadband outdoors solution at 4.9 GHz.

At a broad industry level, the 802.11 ASIC manufacturers are interested in producing huge volumes of chips. Clearly, the potential of embedding 802.11 chips into cell phones, consumer electronics devices, et cetera, is the large volume opportunity that is compelling for chip vendors. The volumes from a market like public safety, even on a global basis, pale in comparison, so there is little incentive to innovate beyond the conventional plain vanilla radios.

As a result, system vendors are purchasing 802.11 chips off-the-shelf to deliver solutions to public safety customers at 4.9 GHz. There is little incentive to articulate the limitations of this reality to customers, so it ends up unspoken or obfuscated.

What can be done? While most people believe that the short cyclic prefix/long delay spread issue is an intractable problem for 802.11 and so have not attempted to resolve it, it is possible to overcome the limitations of the 802.11 PHY with advanced receiver design and digital signal processing techniques. Municipalities, public sector agencies and other potential customers need to begin pressing their vendors to develop solutions compatible with today's standards but which address the limitations of these same standards. Without pressure from customers, vendors will be all too tempted to continue peddling systems that do not adequately, or cost effectively, solve your problem.

Don't let the industry's dirty little secret obliterate your return on investment. WW

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