

A Secondary Broadband Provider for Public Safety

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A first responder may have multiple wireless communications systems to choose from. At least one system must provide service of sufficient quality and availability for mission-critical voice communications during emergencies. I have referred to this as the *primary* system [2]. In addition, that first responder can benefit greatly from access to a variety of other systems that I have referred to as *secondary* [2]. This white paper will briefly summarize some of the advantages of secondary systems in general, and secondary systems providing broadband services in particular. This white paper is a complement to an upcoming Capitol Hill Briefing [1]. This paper will also discuss some of the dangers of using resources intended to build a primary broadband system, and then settling for a secondary broadband system.

Current and Emerging Primary Systems

Today, primary systems are generally operated by local public safety agencies. Unfortunately, when thousands of agencies make independent decisions about their communications systems, they produce an infrastructure that fails more often than it should, consumes more spectrum than it should, and costs more than it should [2, 3]. This is particularly clear when comparing the design of public safety systems with the design of commercial nationwide wireless carriers [3]. The decision to exclude commercial companies is generally justified by the fact that the requirements of first responders are more demanding than those of the general public, and commercial wireless service providers do not meet public safety requirements today. The US should have a nationwide broadband system designed to meet the strict requirements of a primary system for public safety, but alas, it does not.

The FCC is currently considering policies that could lead to the creation of one or more networks in the 700 MHz band that serve public safety, and the general public as well [2, 4, 5, 5]. There may be great efficiencies in serving both groups with the same network. During emergencies, public safety needs access to a great deal of capacity, but most of the time, their communications needs are modest. Through sharing, the public can make good use of this capacity that would otherwise sit idle. If the FCC allows this to occur in 700 MHz, we should hope that the system is built to meet strict public safety requirements. However, this remains to be seen. The challenge for engineers is to serve two groups of users with different needs in a cost-effective way. The challenge for policy-makers is to create incentives for a commercial company to pay the cost of meeting public safety's strict requirements without placing an undue burden on the

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commercial company and deterring investment. Regardless of what the FCC decides in the current proceeding, it will take time to see what emerges in the 700 MHz band.

The Benefits of Secondary Systems

Today's secondary systems include commercial cellular carriers, ad hoc networks operating in unlicensed bands or at 4.9 GHz, and satellite providers [2]. A few cities are considering municipal wifi systems, which may give public safety a new secondary broadband communications system, while increasing the wifi system's chances of achieving financial sustainability [7]. A new nationwide option may be coming as well. M2Z Networks has a proposal [8] to provide broadband service to first responders for free, in return for 20 MHz of spectrum near 2.1 GHz. (M2Z Networks also pledges to make broadband services available to most of the US population, and to pay 5% of their revenues to the US Treasury.) Their network would cover 95% of the US population.

In general, secondary systems provide several important advantages. These include

- *Expanded capabilities.* For example, most primary public safety systems do not support broadband communications today. Secondary systems can give more first responders access to broadband.
- *Greater dependability.* Systems run by public safety agencies sometimes suffer from catastrophic failures, while commercial systems in the same region continue to operate, as occurred in Pennsylvania after Hurricane Ivan [2]. Use of the latter as secondary systems can prevent first responders from doing without communications at all.
- *Better coverage.* There can be holes in the coverage area of public safety systems that are well served by a secondary network. The use of secondary systems gives first responders an effective service area bigger than what is provided by any one network.
- *Lower costs.* The fact that public safety has its own systems, and its own technologies, insures that public safety systems will be expensive, and innovation will be slow. The commercial market is much larger, which brings mass production and rigorous competition. This drives prices down, and gives all parties incentive for continuous improvement. By using commercial systems as secondary systems, public safety can sometimes take advantage of these cost savings.
- *Competition with primary systems.* If policy-makers allow commercial companies to serve as the primary carrier, then there is always a concern that these companies will charge too much or offer inadequate quality of service [5, 5]. Competitive pressure from commercial secondary systems can help somewhat.

The Benefits of Broadband

While we are still in the early stages of broadband use for public safety, there is great potential. The Department of Homeland Security has compiled a long list of possible uses of broadband [9]. For example, placing a video camera with wireless broadband connectivity at the scene of a fire or a police incident may allow remote commanders to make better assessments and better decisions.

Even fairly simple applications can be valuable. For example, as part of a 2004 study at Carnegie Mellon University, we monitored a pilot project to put laptop computers in police cars. We determined that simply giving police officers the ability to file reports from their cars ultimately allowed these officers to spend two extra hours per week on the street, where they can deter and react to crime. Analysis showed that this alone more than compensated for the cost of the pilot. The Alexandria Police Department found that the ability to send text messages over a broadband communications system can also dramatically reduce traffic on the voice system, thereby saving precious capacity [10]. We at CMU hope to do a more extensive empirical study of the benefits of broadband for law enforcement in the future.

Conclusion

The presence of secondary systems can only benefit public safety agencies. This is especially true for secondary systems that provide services that are rarely available in the primary system. This is the case for broadband communications, which may prove to be of great value to public safety. Thus, facilitating the creation of more secondary broadband systems has great potential for benefit, and no risk of harm.

On the other hand, there is significant risk if public safety must invest huge resources, e.g. if a large portion of their 700 MHz allocation goes to a new system. In this case, if the resulting system is not good enough to serve as a primary system for public safety, the policies that allowed its creation should be viewed as failures.

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