

IEEE 802.11b and Bluetooth™ in an Industrial Environment

Mats Andersson

CTO

connectBlue AB

Stora Varvsgatan 11 N:1

SE-211 19 Malmö

Telephone +46 40 23 71 00

Fax +46 40 23 71 37

Mobile +46 733 20 71 05

Mailto: mats.andersson@connectblue.se

www.connectblue.se

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Recently there have been a lot of discussions about Bluetooth versus 802.11b. I believe that this debate have had the wrong focus. The question is not Bluetooth or 802.11 but more Bluetooth and 802.11. I strongly believe that the two technologies will be used in combination with each other. They do have different focus but can be used for different purposes within the same site.

This paper will discuss the issue IEEE 802.11 and Bluetooth in an Industrial Environment in some more detail.

Market perspective

Bluetooth has a major focus as a technology to be built into all kinds of small devices. The technology focuses on small footprint size, low power consumption and low price. Currently the price is rather high, but when the real high volumes are delivered in consumer products the price will decrease rapidly. 802.11b is mainly focusing on the PC (laptop) market which does not the same requirements on small size, power consumption and price.

802.11 is a networking technology

When it comes to functionality there is a major difference between the two technologies. 802.11b is a wireless network and that is all. Of course, this usage scenario is the most important for laptops connected in an office, an airport or other environments where several PCs need to be networked. In this area 802.11 is superior to Bluetooth, supporting features like handover between access points and acting as a transparent wireless network expanding the wired network for example an Ethernet network.

Bluetooth usage scenarios

The 802.11 usage scenario is very different from the usage scenarios described for Bluetooth. It starts with simple "cable replacement" replacing a normal serial cable. Further scenarios are synchronization, wireless printing, wireless headset and many more. There is a wireless networking scenario defined in Bluetooth that somewhat "competes" with the 802.11 scenario. This is needed if you have Bluetooth in a device and need to connect to a LAN, thus avoiding the need for both technologies in one and the same device. But, this is not a real 802.11 competition with its lower bandwidth and lacking of real networking functionality.

The Bluetooth networking scenario will be extended and enhanced in future new versions of the Bluetooth standard, but at the same time 802.11 technologies will move further and support higher transmission rates. The new 802.11a standard or the competing HiperLAN 2 are using a different frequency band than 802.11b and Bluetooth (5Ghz and not 2.4Ghz) This will minimize the interference between the technologies.

Cooperating technologies

My view of the future is that the two technologies 802.11 and Bluetooth will cooperate in a wireless world. 802.11a (or HiperLAN 2) will be the wireless infrastructure interconnecting hotspots wirelessly and at hotspots Bluetooth and 802.11a are used depending on type of device that needs to access a service. Bluetooth is used in small devices like phones, PDA's, home and industrial appliances and 802.11a in more "advanced" devices like laptops and higher level display devices.

Bluetooth will at the same time be used for all non-networking usage scenarios focusing on a person or a single device for example as cable replacement or synchronization of two nearby devices.

There have also been a lot of discussions on interference between the two radio technologies. According to my experience this is not a big problem. Interference will happen but the two technologies are designed to "work around" it. There is also an IEEE working group working on this matter with the objective to minimize the "problem" even more by making the two standards interoperate better. An example is the proposed "adaptive frequency-hopping scheme" in Bluetooth. This scheme finds out which frequencies that interfere and avoids them (see reference 3). In the future they will move to different frequencies for example when 802.11b moves to 802.11a or similar techniques!

More information on Bluetooth and 802.11b interference is given in references 1, 2 and 3.

The Industrial Perspective

From an industrial perspective, we I believe there will be many 802.11(a and b) networks in the industry environment but for many small devices (small in footprint, power and/or price again) Bluetooth are a more suitable technology. Of course these devices need to be able to communicate with other networks (wired or wireless) using different types of access points (one access point may serve many Bluetooth devices). The Access points must support both Ethernet networks and traditional industrial Fieldbus networks like Controlnet, Fieldbus Foundation, or Profibus. All to support the large installed base but there are many standalone devices in the industry where Bluetooth may serve as a cost-effective cable replacement technology.

Reference 4 is an overview of ABB's view on industrial use of Bluetooth and reference 5 summarize reliability issues when using Bluetooth in an industrial environment.

References

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About the author

Mats Andersson is CTO (Chief Technology Officer) of connectBlue AB, Sweden. connectBlue is specializing in integrating Bluetooth based solutions in industrial and commercial devices. The company's services include consulting, training and complete solutions including hardware and software.

Mats Andersson has more than 20 years experience in the field of industrial automation. This includes managing development of industrial automation products at AlfaLaval Automation and ABB Automation Products.

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