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# Optimizing Wireless Reliability



Bernhard Wiegel

5/30/18

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Wireless Ethernet technology can be an extremely powerful tool for both the IT and OT environments—it makes it possible to successfully incorporate areas into the network that would otherwise remain silent. Whether it's linking remote locations such as depots or offshore rigs; pulling in data from vehicles or field people carrying handheld sensors; or flexibly integrating other applications where cabling is just not possible, wireless can give you instant, reliable connectivity nearly anywhere.

Of course, “reliable” is a relative term. Since wired networks have become so reliable and are already trusted, the inevitable gap between wired and wireless can skew perspective and scare some people off from the benefits of wireless technology. And that’s a shame. Truth is, it may never be practical to make wireless fully as reliable as wired connectivity—that’s just physics. But, like wired, wireless is getting better and better, and, with

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proper planning and equipment, wireless can be an extremely reliable tool perfectly suitable for many, many applications.

In fact, we are seeing wireless deployed more and more in the type of critical applications that may have been considered impossible just a few years ago. Technologies such as strategic use of multiple redundancy mechanisms are bringing these applications well within stringent reliability goal ranges, even for vital safety functions like train control. Here are some other aspects to consider as you work to optimize the reliability of the wireless portions of your networks.



### Maximizing signal strength

When people say reliability, what they are really talking about for the most part is maintaining the optimum signal to noise ratio, and that means either working to improve the signal or working to reduce the noise, depending on the issues inherent to the particular situation. Often that starts with the proper coverage for the terrain and such issues as antenna selection, with proper placement and installation, as well as studies regarding dead areas or other spots of weak coverage and resulting mediation to remedy them. There are many experts and many products readily available that can help improve signal strength and smooth over most challenges to ensure that you get the coverage you are seeking throughout the target area.



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If you are getting good coverage of your signal but still having reliability issues look to the noise side of the signal-to-noise ratio. Interference is a common problem—ensure that there is not a lot of conflicting traffic on the same channel from elsewhere in your organization, such as your IT Department. In many organizations, unfortunately, OT and IT goals operate in silos and you may be inadvertently stepping on each other's communications quality. Fortunately, once the problem is diagnosed it can usually be readily fixed for everyone. Similarly, we often see issues with interference from the environment. Electrical noise flowing from high voltage equipment like ubiquitous VFDs much less massive ten ton presses are endemic to many industrial environments and that constant or even intermittent barrage is a common culprit in the erosion of signal strength. Professional frequency planning by trained experts is key when setting up a new wireless network to avoid problems down the road, and similar expertise can be engaged to improve conditions in existing networks as well.

In existing networks, among many other custom aspects of your equipment and terrain, the experts will certainly consider the frequency band and IEEE standard that you are utilizing. The 2.4 GHz band was the most common and got very crowded; the emergence of the 5 GHz band eased traffic noise considerably, so a band move and traffic redistribution may be a consideration for many operations. Similarly, the emergence of IEEE 802.11n a few years ago provided a huge boost to wireless reliability, so if your system is utilizing earlier versions 802.11 a, b or g, a change may also be a consideration. In addition, the latest version of the standard, 802.11ac, provides higher data rates and speeds, not only providing significantly better performance, but also, by decreasing transmission times, potentially improving reliability as well.



## Look to security too

As noted, there is a wide universe of technology tools than can be applied to most any coverage or capacity challenge. If packet loss cannot be avoided through expert frequency planning, Wireless PRP (Parallel Redundancy Protocol), products can be brought to bear, providing two parallel links per transmission. If you have a mix of older and newer nodes, as many do, the initiation of Airtime Fairness protocols can help optimize the distribution of airtime and increase the performance of the overall network.

When looking to improve reliability, always remember that security is intertwined with it. A move in one can impact the other, so be sure to educate yourself on the impacts of any changes and upgrades. For example, moving up the 802.11 chain (from WEP with legacy IEEE 802.11 a/b to WPA2) can not only improve reliability but bolster network security as well, giving you a two-fer and providing even more incentive to retire outdated legacy systems.

The bottom line I believe is that wireless can be both reliable and secure for many, many applications, but getting optimal service doesn't just happen—it takes knowledge and planning, and making use of both high quality products and high quality expertise. Something that works on paper won't necessarily work on-site—like discovering IT channel interference on your OT network the hard way. So it pays to avoid underestimating the short term planning that needs to be done to ensure long term reliability, security and performance. Due diligence is the key to getting outstanding results. If you'd like to find out more, we'd welcome a conversation.



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## Bernhard Wiegel

Bernhard Wiegel has been with Belden since 2012 and specializes in wireless communication and networks. His current role at Belden/Hirschmann is the product owner wireless, leading the R&D team that is developing the product of the Hirschmann WiFi and Cellular portfolio. In the past, Bernhard had the role of a senior software developer and was leading the development of the HiLCOS software, which is running on most Hirschmann Wireless products. Bernhard received a diploma degree in electrical engineering in 2006 and a doctoral degree in 2013 both from Ulm University, Germany. During his research activities at Ulm University, his main focus was on wireless communication between mobile systems and quality of service for inter-vehicular communication systems.

## Comments

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**Charles Palmer** 5/30/2018, 10:17:47 AM

Good day Bernhard, impressive career. Well done.

I provide some 25 technical courses across the African Continent. My profession is Instrumentation & Control and in my advanced Instrumentation course I provide in depth studies on the application of Wireless Technology. Main problems I have observed have been from Lightning strikes and I would value your advice on how this natural phenomenon can be countered; also information on any latest technological advances would be a blessing. Much appreciated,  
Charles Palmer Phd Engineering Instrumentation

Reply to *Charles Palmer*

**Amy Walton** 5/31/2018, 9:58:47 AM

Hi Charles,

We'd love to get you connected with Bernhard to answer your questions! If you will send me an email with your contact information I will make sure that happens.  
Amy.Walton@belden.com

Thanks for being a part of our blog community!

-Amy

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**Amy Walton** 5/31/2018, 9:56:27 AM

Hi Charles,

We'd love to get you connected with Bernhard to answer your questions! If you will send me an email with your contact information I will make sure that happens. Amy.Walton@belden.com

Thanks for being a part of our blog community!

-Amy

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