

# Technical Whitepaper

## Why is Wireless Performance So Confusing?

A widespread frustration with Wireless is that two people can be in the same room, at the same time, with the same type of device ... and have completely different wireless experiences. Why can this happen and what can you do about it?

### Background

One of the common misconceptions about wireless is that your device always connects to the strongest Access Point (AP) all the time, therefore when sat next to someone you must both be on the same AP. Not true unfortunately and this leads to a host of issues.

### The Technology

In simplified terms, when your device first detects a wireless network it forms a list of all the APs advertising it and sorts them by signal strength. Your device will then connect to the AP on the top of the list and this then dictates how you are going to be handled around the network.

As you move around a location your device stays connected to the same AP until the signal strength drops to what is known as the re-association point. This is the number (signal strength) at which the device starts to look for another AP to connect with. There are a few caveats here; the signal has to drop below this level for a few seconds before the devices attempts to jump therefore when moving in and out of coverage, the default behaviour of the devices is to stay where they are.

Assuming there is a stronger signal to jump to the drivers in your device and the wireless network hand you across to the next AP and the process begins again. If there is not a better signal to connect to, then the device will hang on to the same AP until the signal level reaches the minimum strength the wireless drivers will accept and then disconnect you.

What does not happen is your device always jumping to the best (strongest) signal every time you walk near another AP. It is perfectly normal to walk past several APs before you disconnect from the first one as you haven't reached the re-association point. This is a function of your wireless coverage and explains why too many APs can be a waste of time and money.

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## The Implications

The first implication of this is that two people with the same device, who enter the building via different doors, will be handed across the network in different ways. It is therefore perfectly possible for them to end up at the same desk whilst still connected to completely different APs; perhaps one person's device has just hit the re-association point and jumped to the AP nearest them, but the other device came in from a different direction and still has a minimum but acceptable coverage from the AP down the corridor. Since the speed of connection is a function of Signal to Noise Ratio they are likely to be getting different speeds.



The second implication is that people entering the building by the same door but taking different paths to their desk could also find themselves connected to different APs due to the same reasons.

The third implication is based around operating systems. The re-association point and minimum connection level are part of the wireless driver settings and as such not standardized. This means that if you had an IOS device and a Windows device in your pocket, by the time you get to your desk they could well be connected to different Access Points!

The fourth implication occurs between the point that the device wants to find a new Access Point but can't and when they finally drop off completely. In this area, the device is connected but likely to have poor performance. The rules state that you can't jump to a better AP unless it's better than the re-association level. For example, a device with a signal of -78db can't jump to a signal of -72db (which is 200% better) because the re-association point is -70db. When the device does let go (around -80db for Windows) you need to get back to a -70db signal to reconnect. This means that areas that were working are not good enough to reconnect in, you have to get back to the re-association level before you can re-join.

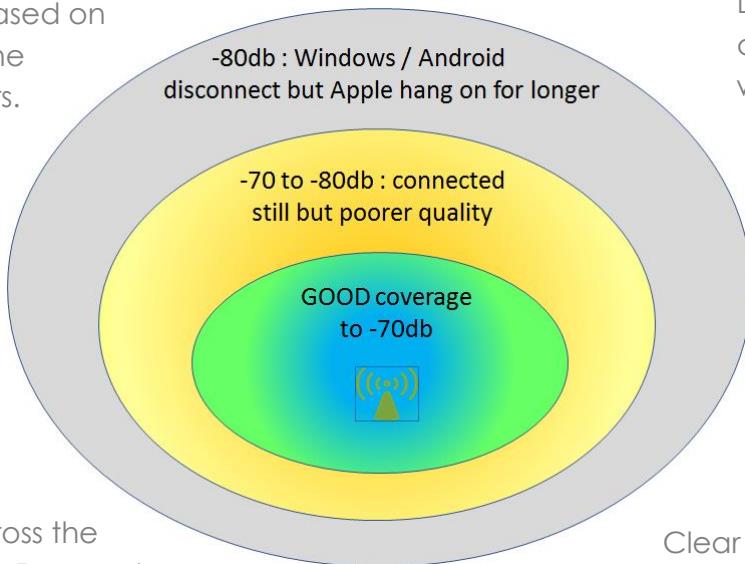
All the above behaviour is not wrong, these are merely the effects of how the wireless technology works.

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## Wireless Summary

Exact boundary points vary based on the OS and the wireless drivers.

When in "Good" coverage your device ignores all other APs even if they offer a stronger signal.



You have to cross the boundary for 3-5 seconds before your device will make the jump to the next AP.

Default state of a device is to stay where it is.

Once disconnected you have to move back to Good signal to reconnect.

Clear coverage boundaries between APs helps a lot.

## So, what can you do about this?

The first step is to understand that just installing more Access Points doesn't make this situation any better. The devices will still only move when they reach the re-association points and ignore everything in-between.

The second is to understand your wireless coverage better and manage it so devices move between APs in a more defined way.

The next point to consider is that the performance achieved over Wireless is a combination of many things but mostly based on Signal to Noise Ratio. The biggest contributors to noise are wireless devices and wireless APs, so you do affect your own environment.

Many wireless controller technologies claim to manage these situations for you and some of the features are indeed very useful, however the device decides when it's going to move between APs and all you are really doing is influencing these situations. (Meru, now Fortinet, is very different here). Also, be aware of the auto settings on wireless controllers claiming to sort things out for you. They work within certain parameters but if your network has a lot of APs or in a noisy environment those parameters are probably too high and need adjusting.

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## Getting the right information

Wireless is difficult, wireless can be a challenge... however there are lots of tools out there to help you, designed purely to make the day to day management of the wireless environment much easier.

The most common complaint might be "the wireless isn't working!" The troubleshooting tool we use is the [NETSCOUT AirCheck](#), a small, handheld tool for fast, definitive answers inside one minute on: how the wireless network is configured, what Access Points are available, signal strengths, Signal to Noise ratio's and the ability to locate Access Points and clients.

The biggest concern you may have is "Have we got the coverage optimized?" For this you need a survey tool, our preferred choice is [AirMagnet Survey PRO](#) which produces heat maps of the building showing how each individual Access Point propagates, what data rates can be expected, where Access Points overlap; allowing you to see exactly how the wireless performs and how to adjust it to gain the optimum performance.

If you are spending money on a new wireless installation, we recommend a specialist software planning tool, such as [AirMagnet Planner](#), which enables you to design a wireless installation from scratch; calculating how many Access Points are needed and their best locations to cover your desired specification. Saving time, and optimising the Access Points required, so ultimately saving money!

For those concerned about noise and sources of interference on their network, products exist which just analyse wireless at Layer 1, these are called spectrum analysers. We recommend [AirMagnet Spectrum XT](#), a dedicated Spectrum Analyser that matches interfering wireless signatures against a database, to tell you if the source is a microwave, or Bluetooth device etc, plus which channels are effected.

For permanent monitoring or to secure your wireless and provide 24x7 compliance reporting, then our recommendation is [AirMagnet Enterprise](#). Using sensors deployed to gather information the solution reports who is on the network, when and how the network is performing. Any new, unauthorised networks will raise an alert and can be disabled by the sensors keeping you secure and compliant.

Wireless might just be something that you don't have the resource for right now, therefore as an alternative why not consider our [Professional Services](#)? We can perform all of the above, tailored to your needs, whether it be planning a new design through to picking a vendor for your wireless. We can survey your existing wireless to help troubleshoot an issue or to solve performance complaints, just contact us at [info@fullcontrolnetworks.co.uk](mailto:info@fullcontrolnetworks.co.uk) or take a look at our [website](#), we will be happy to help!