The challenges of ensuring excellent voice quality in a Wi-Fi workplace

A SPECTRALINK WHITE PAPER

Introduction

In the last few years, smartphones have come to be the phone of choice for many of us, both in our personal and business lives.

Almost all smartphones have the ability to connect to both cellular and Wi-Fi networks. These devices are designed to optimize the use of both networks, using each for what they are best for. Generally, voice traffic is carried on the cellular network and if a Wi-Fi network is available, data traffic is carried over Wi-Fi.

However, in many work environments, smartphones can't or don't connect to the cellular network and are strictly limited to Wi-Fi connectivity. This could be because of the expense of cellular subscription plans, poor cellular coverage, or the wish to use existing Wi-Fi infrastructure. When deployed in these situations, smartphones are dependent on the Wi-Fi network not only for data but also for voice.

Voice over Wireless LAN (VoWLAN), is the term used to describe voice traffic carried over a Wi-Fi network. When designed and implemented correctly, a VoWLAN solution can deliver very high quality voice to mobile users who are solely dependent on a Wi-Fi network for connectivity. But while the latest and shiniest smartphones can be alluring for many, when it comes to delivering the quality of voice over WLAN, these can often fall well short of the mark. Rather, these users need a mobile communications device that is purpose built and optimized to deliver excellent VoWLAN.

Workers facing these scenarios are typically found in three main vertical industries – healthcare, retail and manufacturing – but can also be found in a range of other sectors. Examples include a nurse roaming a hospital unit, a retail associate working the sales floor, or a warehouse picker or manufacturing worker on a production line.

This white paper looks into why voice is so unique and addresses the core capabilities - the 'secret sauce' if you will - needed to ensure the level of quality and consistency required for those voice-critical uses.

Why Voice is Unique

When information is delivered over a Wi-Fi network, sometimes data can get delayed or lost in transmission. When this happens, these packets are corrected or resent. This process normally takes just a few milliseconds and has no discernible impact on normal applications such as web browsing or transferring files. Voice over WLAN carries voice traffic as data over the Wi-Fi network making voice traffic vulnerable to the same issues as any other data transmission. When data loss, delays or corruption happen to a VoWLAN call, the effect can be much more dramatic, resulting in poor clarity as well as popping and crackling sounds, or even causing the call to drop entirely.

In order to avoid this problem, the entire VoWLAN ecosystem needs to be implemented and configured in such a way that calls are of the highest quality. Achieving this means that voice transmissions take priority over any other network traffic, handovers between access points need to be seamless and that any individual point in the system does not get overloaded.

Achieving this configuration requires a combination of specialized hardware and software built into the handsets and network access points.

Voice Prioritization

The human ear is extremely sensitive to distortion of sounds, and voice quality has always been one the top priorities when selecting a handset for use by mobile knowledge professionals. Voice applications have a very low tolerance for network errors and delays and gaps of only a few hundred milliseconds can severely deteriorate voice call quality.

Smartphones are primarily designed for cellular voice calls and data. Data traffic is often delivered in bursts and quite sporadic. This is acceptable because data applications can tolerate network congestion with reduced throughput and slower response times. When talking to a friend or colleague on a typical mobile phone it's generally considered acceptable if you have to occasionally ask them to repeat themselves or even if the call drops.

For on-site professionals, the expectation is for a reliable, clear call – every time. The risk of inaccurate patient information or losing a sale is too great. As such, businesses often look to VoWLAN, rather than cellular, to ensure call quality for their mobile knowledge workers.

Most smartphones do support Wi-Fi functionality but this support is optimized for data, not voice, and is typically missing key features such as Quality of Service (QoS) support for prioritizing voice packets. As such, one of the greatest challenges for smartphones in an in-building work environment is delivering acceptable voice quality when using an organization's in-building Wi-Fi network.

Voice traffic cannot tolerate unpredictable delays, where the bandwidth requirements are much more constant and consistent. In a work environment that relies on high quality, mobile calls, the handsets used need to incorporate specialized components to optimize all aspects of the call.

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Seamless Roaming and Hand-offs

Making and receiving voice calls is still the primary use for in-building mobile communications devices. Interrupted or dropped phone calls can create frustration for employees and customers or patients. It is critical to maintain the equivalent voice quality, reliability and functionality as is expected from a wired telephone.

Another factor to consider when determining the coverage area is device usage. Wireless handsets are used differently than wireless data devices. Telephone users tend to walk as they talk, while data users are usually stationary or periodically nomadic.

Purpose-built handsets are designed to deliver a continuous, reliable voice connection as a user moves throughout the building or campus. Users move from hallway to patient room to meeting room, roaming from one access point to another during the transition, with no loss of packets or degradation of audio quality.

Furthermore, signal strength is impacted by how and where the users hold their phones compared to other devices. This factor may result in reduced range for a Wi-Fi phone compared to a data device. Therefore the Wi-Fi network layout should account for some reduction of radio signal propagation.

To provide seamless connectivity for VoWLAN applications, the access points (APs) must be positioned with sufficient overlapping coverage of handsets to ensure there are no gaps, or dead spots, between them.

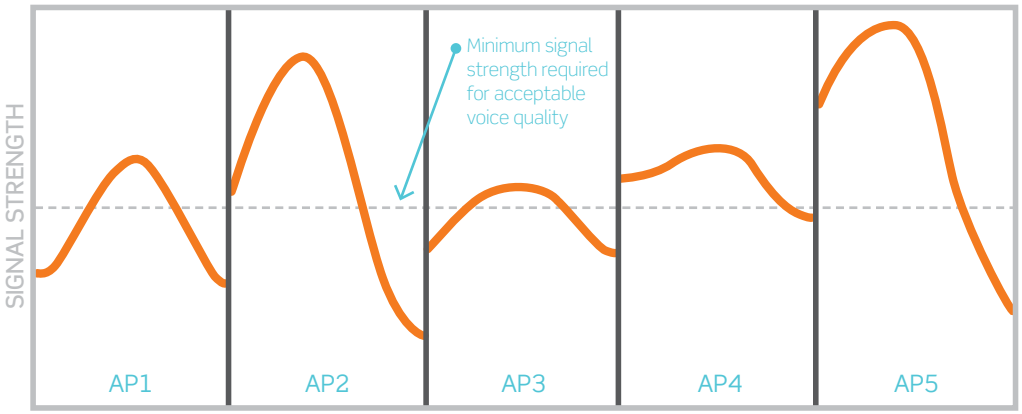

Figure 1: Typical smartphone AP hand-off in the enterprise

In this case, when a user walks between coverage zones, the call is handed off to the next closest access point when the user moves out of range from one AP to the next. Without overlapping coverage, call quality can be adversely affected.

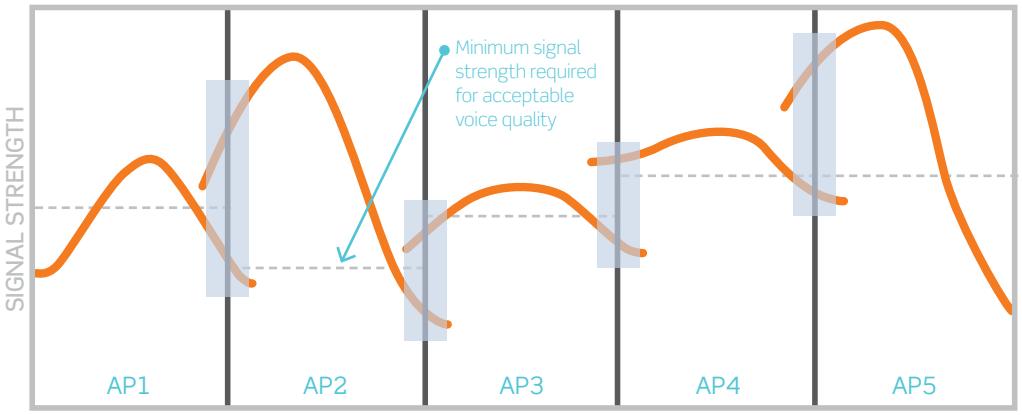

Figure 2: Voice over Wi-Fi hand-off optimized for the enterprise

In this case, as a user walks between coverage zones, the hand-off of the call is pre-negotiated so there is no degradation of the call quality between hand-offs.

As wireless voice users move throughout the workplace, the device will seek out other APs to roam to in order to maintain the most reliable network connection. Most consumer smartphones don't do this in a particularly intelligent way. Most will wait until the signal from the AP they are attached to is very weak, before seeking a new one to connect to. A dedicated voice-optimized handset will constantly seek the strongest connection available on the network in order to ensure that the phone can always be reached and that voice-quality remains high. Similarly, these phones are especially designed so that the hand-off – switching from one AP to another – is always seamless, even mid-call.

Purpose-built handsets allow users to move from hallway to patient room to meeting room, roaming from one access point to another during the transition, with no loss of packets or degradation of audio quality.

Admission Control

As well as the layout and configuration of the network's access points, network capacity requirements are a factor in the number of APs required. In busy areas such as meeting rooms and communal areas, where it's common for data and voice to compete for bandwidth, it is necessary to have mechanisms to prioritize voice packets over data, preserve battery life for handhelds, and allocate appropriate AP bandwidth for the device's supported applications.

The final component is called Admission Control and allows the AP to manage its available 'air time' based on traffic requirements submitted by associated clients and rejects requests if insufficient resources are available. When Admission Control is properly implemented it avoids over-subscription of the AP, therefore preserving and protecting QoS for all associated devices.

The Admission Control facility considers the entire network and all the devices and handsets connected to it at any given moment. The intelligence comes with real-time monitoring that allocates the network resources, connecting handsets to APs in such a way as to balance the load as evenly as possible.

A part of this load balancing includes predicting expected traffic-flow and call patterns and reacting accordingly. When voice traffic can be accurately predicted using probabilistic usage models, this allows a network to be designed with high confidence in meeting anticipated voice capacity requirements.

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Conclusion

As smartphones continue to extend their march into the workplace, it is becoming increasingly clear that they are not always the right choice for the specialized needs of in-building mobile employees working in vertical industries such as healthcare, retail and manufacturing.

In the case of companies that have a large percentage of in-house mobile employees and use in-building wireless, the benefits of purpose-built devices easily outweigh that of smartphones, which are simply not fit for purpose.

Consumer phones cannot deliver on these features – there simply isn't an app for that. This impacts productivity and limits how effectively the network can be deployed or configured to optimize call quality and reliability.

The right devices will incorporate a 'secret sauce' – a combination of hardware and software - to provide the voice quality, seamless roaming and admission control functionality that these mobile knowledge workers require. Similarly, they are specifically designed to be able to work in harmony with the organization's network to avoid any issues of congestion or capacity overload.

It is the secret sauce within these devices and their connection to a properly configured network that makes sure these vital roles are not undermined.

About Spectralink

Spectralink, a global leader in wireless solutions, solves the everyday problems of mobile workers through technology, innovation and integration that enable them to do their jobs better. By constantly listening to how customers move through their workdays, Spectralink is able to develop reliable, enterprise-grade voice and data solutions and deliver them through a powerful, durable device.

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