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### Wireless Real Time Location Services



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Wireless Real Time Location Services

Wireless networks have never been more popular and available. With the explosion of consumer and business wireless networking in the past few years, I receive many questions related to the planning, deployment and managing of Wireless Lans or WLANs. Based on 802.11 IEEE standards, these WiFi networks can solve and create problems at the same time. This post is an effort to consolidate the discussion of some of these issues and to establish a perspective for what WLANs can, cannot and in some cases, should not do. One new technology that deserves a look is Real Time Location Services. RTLS can actively track a "tagged" device or asset. For example, finding a hospital emergency room crash cart or an Alzheimer's patient. Knowing a location is highly valuable in managing critical assets and in avoiding liability. Until recently RTLS was only available on a small scale using expensive high resolution scanners. Now RTLS can be provided over an unlicensed radio based system. Should we expect or even hope that this exciting new service should run on WLAN? Let's take a look.

Consumers and businesses alike can take advantage of the mobility that WLANs provide. New WLAN features and speeds dwarf the capabilities of wired networks from just a few years ago. One common misunderstanding is that WLANs are the functional equivalent of wired networks. This is far from true. With more implementations appearing daily the WLAN radio spectrum is getting crowded. Many delay sensitive applications such as Voice over IP and Video are being introduced that require more and more bandwidth. Newer standards such as 802.11g and 802.11n require sophisticated signaling to allow older 802.11b devices to co exist with these new networks. Did you know that when just one 802.11b client associates to an 802.11g access point, the available speed is reduced to accommodate a broadcast to the b client? Complex methods like

protected 802.11g must be introduced to set aside bandwidth for g speed operation while still giving time to the b client. With the introduction of 802.11n the need to provide backward compatibility will reduce the high bandwidth available to the n client. Do you get the idea? Each new turn of the technology crank makes it very hard to first protect the investment you made just a few years ago and second to successfully roll out some of the new wireless capabilities now becoming available. See appendix A for more information on co-existence of 802.11 standards.

Much is being made of Real Time Location Services that will run on WiFi networks. I believe the expectation for RTLS on WiFi should be at best a casual use service. This will allow for non critical assets and devices to be located provided the RF is reasonably immune to changes and outside influence. Is this what RTLS is really intended for? Absolutely not! RTLS has tremendous promise but the possibility of thousands of RTLS clients coexisting on a potentially unstable evolving WLAN will hardly create the necessary confidence for wide acceptance. WLANs were first used for casual data access, file sharing, web browsing, email, etc. This works fine for best effort traffic. The introduction of voice and video requires newer, more sophisticated hardware, more and faster APs and intensive RF planning. Adding thousands of 802.11b RTLS clients will usurp the tremendous value built into an up to date network. Even without the b, g, n coexistence issues, the network can be overloaded.

What is the alternative to WiFi for providing highly scalable RTLS? It needs to be wireless, it needs to be pervasive and it needs to exist outside the ever changing WiFi RF spectrum! Use other available unlicensed RF spectrum such as 900Mhz. This spectrum has been largely overlooked with the development of 2.4 and 5.8 Ghz technologies. RTLS does not require high bandwidth and with spread spectrum technology it can inherently overcome interference issues.

Let's look at some other reasons why a single purpose 900 Mhz RTLS solution can make more sense than shared purpose WiFi system.

- \* RTLS WiFi offerings use 802.11b clients to keep down chipset cost and to boost battery life.

- \* Given the level of investment and value placed in an upgradeable access point network, and the anticipated applications they will support, it is not reasonable to accept that an investment in adopting a legacy 802.11b based RTLS system. Even a brand-new laptop purchased in 2006 will "time out" after 3 to 4 years of use, and that will be the end of life for the legacy 802.11b client. A new RTLS system should certainly be planned to have a longer amortization period than the battery life of the tags! Further, the cost of the additional access points (and relocation of existing access points) needed to supply good location resolution will be prohibitive.

- \* Access points have finite association table space. High densities of WiFi RTLS tags can rapidly fill these tables, effectively creating a denial-of-service

scenario for data users.

\* RTLS tags operated in modes that support WiFi QoS mechanisms consume large amounts of battery power because they need to actively monitor the channel they occupy. If applications that are QoS dependent (such as VoIP) are deployed, these services can easily be encumbered by tag densities of just one or two devices per room. If the tags are not participating in QoS control mechanisms to save battery life, then the VoIP applications may be limited to a few sessions per area, or, not work at all.

\* WiFi bandwidth availability is a critical factor. With so many concurrent WiFi networks in existence, and new emerging standards like Ultra Wideband competing for spectrum, there is increasing need for WiFi technology changes to deal with to deal with interference. Change can be good but not for a substantial investment in RTLS on WiFi.

\* Bandwidth consumption during the location tracking process Forces APs & controllers to do extra work, often during background scanning intervals. This can not only cause additional latency, harmful to real-time applications such as voice & video, but depending upon the system, the voice traffic may temporarily disable the background scanning, affecting the accuracy of the location service, and how current the information is.

\* The IEEE P802.11k working group (sub-task interest area) of the 802.11 'WiFi' standardization committee is working on the needed standards for what they refer to as "radio resources." In other words, 802.11k is to be the common ground for future WiFi access points, in terms of what the radio frequency sections of such equipment are capable of. The standard creation process for the 802.11k working group has been delayed beyond the originally agreed-to timeframe. Many of the core elements of 802.11k relate to the future ability of WiFi access points to be used as part of a robust, more-accurate RTLS system. Without such capabilities standardized, we are left with rudimentary or non-existent reporting capacity for location resolution. Because this standardization process is delayed, it's not good news for WiFi RTLS fans. There's no standard for them to point to, and there won't be one for up to two more years. With other changes to the WiFi standards, this makes an investment in a WiFi RTLS system have a short lifespan.

The conclusion is that an investment in a WiFi based RTLS system can at best be considered "casual" and not for use in a very high density tag environment. For an RTLS system to be a true asset, it should be an independent utility not subject to the changes and over hype of WiFi. I feel a 900Mhz system will provide long useful life, security for being unobtrusive by not being tied to a highly visible WLAN service and industry tailored investment protection for assets.

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## Appendix A

### 802.11 Legacy Coexistence

The IEEE TGN standards group requires backward compatibility with 802.11a/b/g devices. Industry experts expect legacy 802.11b devices will coexist for some time to come, and legacy 802.11a/g devices will interoperate with 802.11n devices when operating in the same band and channel. Of course, the interoperating systems will have to "vote down" to the lowest common denominator. Coexistence mechanisms, many not yet realized and almost all vendor dependent, will need to manage channel bandwidth mismatches in mixed environments and ensure that mixed mode operation is supported with low-overhead between 802.11n and legacy 802.11a or 802.11g. This means 802.11n will need to support 20-MHz channels, as opposed to their normal 40 MHz, for backward compatibility. Users are likely to have to manually set their 802.11n access points into some kind of compatibility mode that degrades the performance of the 802.11n network, in order to facilitate support of legacy hardware.

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