Optimizing a Wireless LAN for Location

Scores of hospitals have made a strategic investment in wireless local area network (WLAN) infrastructures, enabling remote data access and voice over IP (VoIP). This wireless networking has untethered doctors, nurses and other clinical staff, enabling unprecedented improvements in quality of care.

Now, hospital IT directors are looking ahead to what's next.

These IT directors are raising the bar for ROI another notch, adapting WLAN infrastructures for the next generation of such applications as real-time asset tracking. Asset tracking is a top priority for many hospitals searching for better ways to locate, deploy or service expensive and highly mobile biomedical equipment.

Michael McGuinness

For all classes of critical assets—from beds to wheelchairs to ventilators and portable monitors—many hospitals over-procure by as much as 20 to 30 percent, just to accommodate for lost or misplaced equipment. Eliminating this unnecessary spending, coupled with reducing staff time spent searching for equipment, can save hospitals millions of dollars.

In most instances, the business case for real-time location systems (RTLS) is made even more attractive because of the ability of hospitals to use the infrastructure they already have in place. Standards-based Wi-Fi deployments—with a little tuning or enhancement—are able to locate RFID-tagged assets, extending the value of an investment in a WLAN infrastructure.

The key to a successful asset-tracking deployment often lies in understanding the capabilities of the wireless network.

Identifying What You Need to Track

The first question most IT directors ask is, “How accurately can the system locate devices?” The answer to this question lies in the design of the network and the physical characteristics of the environment in which the devices are to be located. But perhaps the more important question to ask is this: “What do I most need to track?”

Various use cases require different levels of accuracy. A biomedical engineer tasked to repair a piece of medical equipment may need to know only its general vicinity. On the other hand, a discharged patient leaving his room triggers a series of housekeeping tasks, in which case, room-level accuracy is critical to speed hospital throughput.

Identifying what you need to track and how to track it—with potentially varying degrees of accuracy—can result in improved business processes, allowing you to assess and plan a network deployment that supports the use cases most important to you.

Coverage, Capacity and Quality of Service

If a Wi-Fi network was originally deployed to support a single application, such as remote data access, it’s likely additional access points (APs) will be required to optimize the WLAN for location-based tracking.

Regardless of whether you use an already-deployed wireless network that’s subsequently optimized for location tracking, or new network infrastructure designed from scratch with location tracking in mind, a Wi-Fi network can provide a highly reliable level of accuracy. To achieve this desired level of location accuracy, the tag or other tracked Wi-Fi device should be visible by three or more Wi-Fi access points at signal strengths consistently moderate to strong. An AP should report the wireless asset tag’s or client’s received signal strength indication (RSSI) at a level of -75dB or better.

While this may require an additional infrastructure investment, the standards-based approach to location-based tracking—leveraging Wi-Fi networks—remains the most cost-effective and IT-friendly approach compared with the adding a single-purpose, non-standard overlay network.

Moreover, installing additional 802.11 access points to the WLAN will strengthen the overall network to provide better wireless coverage, capacity and quality of service for all of its users and applications, including data, voice and location-based tracking.
Placement of Access Points

A second factor that affects location accuracy is the physical environment of the tracking area. The strength of a radio frequency (RF) signal provides location information, and RF characteristics such as reflection, attenuation and multi-path are unique in every environment.

Advanced Wi-Fi tracking systems such as the Cisco Unified Wireless Location Appliance, can account for how building materials, doors, walls and other large objects impact RF signals and location accuracy, effectively tuning the system for the specific environment in which it is operating.

Jeffrey
Rideout
To determine the optimum location of all devices in the wireless LAN coverage areas, consider the access points' density and location:

- Most importantly, access points should surround the desired location.
- Roughly one access point should be placed every 50 to 70 linear feet (17 to 20 meters). This translates into one access point every 2,500 to 5,000 square feet (230 to 450 square meters). APs should be separated by 50 to 70 feet.
- Place access points along the periphery and in the center of coverage areas to locate devices close to the exterior of rooms and buildings, while providing reliable data.
- Increasing overall access-point density and moving access points towards the perimeter of the coverage area, location accuracy is greatly improved.
- In long and narrow coverage areas, avoid placing access points in a straight line; instead, stagger them so each access point is more likely to provide a more distinctive snapshot of device location.
- To minimize the degree of co-channel interference, traditional best practice recommends deploying access points on alternating non-overlapping channels, using directional antennas where possible and judiciously limiting access point power levels as necessary.