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The Optimal RTLS Solution for Hospitals

Breaking Through a Complex Environment

For years, hospitals have searched for a comprehensive solution to accurately track patients, personnel and equipment in what is typically a complex, dynamic and often chaotic environment. Because of the unique character of hospital operations, people, physical assets and myriad clinical resources are constantly in motion. Many of these activities occur independently of a coordinated workflow. Not surprisingly, hospitals exhaust vast amounts of capital locating missing equipment (and replacing lost equipment); in staff diverted to unproductive "hunting and gathering" tasks; in addressing the resulting service bottlenecks; and in overspend for underutilized assets. It all adds up to the kind of preventable waste that hospitals just can't afford.

To address these workflow and utilization issues hospitals have turned to RTLS (Real Time Location System) solutions, with varying degrees of success. In its widest application, RTLS has been successful as an asset management tool. But many tracking solutions have proven difficult, costly and disruptive to install or have failed to accurately pinpoint assets with an acceptable level of precision.

To add another dimension of complexity to the RTLS debate, companies with competing system architectures—Wi-Fi (AeroScout), Infrared/RF (CenTrak), UWB (Parco), ZigBee (Awarepoint), Ultrasound (Sonitor)—each claim to deliver the highest level of tracking precision in the most efficient manner.

To illustrate this dilemma, consider one popular technology solution, Wi-Fi. It has advantages and limitations. For many facilities, the decision to implement Wi-Fi-RTLS is heavily influenced by the existence of a Wi-Fi infrastructure, which, in theory, eliminates the need to introduce a dedicated RTLS architecture. But Wi-Fi accuracy is a chronic issue (averaging to as much as 30 feet), making it suitable primarily for asset tracking. Despite its limitations, price often drives the decision to employ Wi-Fi-RTLS, and in some asset tracking applications, knowing where an item is "approximately" may be enough. But from a technology standpoint, healthcare is not a particularly friendly environment for Wi-Fi-based RTLS—tags are large and expensive and battery life is uncertain. Even the physics of Wi-Fi RF technology limit the potential level of Wi-Fi precision to floor level at best and certainly not room-level accuracy. In the hospital, a communications based Wi-Fi infrastructure must be "beefed up" to accommodate RTLS, and many Wi-Fi access points must be distributed throughout the facility to achieve any true value from the system. Invariably, the total cost of ownership related to Wi-Fi based RTLS extends far beyond the initial installation, and as a result the expected savings often fail to materialize. An alternative solution that delivers a higher order of accuracy and reliability is a dedicated RFID system configuration, but this requires implementation of a parallel wireless infrastructure. Although RFID performs well in open spaces, RFID accuracy within buildings is reduced to a "bubble," as RF signals tend to bleed through walls and floors. The bottom line: each RTLS technology has advantages and flaws. The challenge is to architect to the pain points of the hospitals—this year, next year and five years from now.

The first step in defining an RTLS infrastructure solution is to understand the problems that need solving. Each department in a facility has its unique array of pain points, and one single RTLS solution must address each of them with equal effectiveness and efficiency. There is a hierarchy of tracking needs, proceeding from simple locating and identifying (equipment, supplies, etc.), to tracking (current status of people and things, over time), to communications (delivering information about the status of a tracked item to the right people or software application at the correct level of detail), and finally to workflow (using business rules to anticipate and facilitate process improvement).

The RTLS infrastructure should not only meet the requirements for the current problem, but be flexible enough to accommodate more ambitious tracking goals as the various departments and applications link into the RTLS information. In short, what is needed is not a "spot" but an enterprise solution, one that can be scaled to meet a variety of tracking challenges

across the locating/tracking/communications/workflow hierarchy.

There are many applications of RTLS in the hospital, and it is the potential benefits that should frame the solution requirements. The most common applications of RTLS in the hospital fall within several broad categories: asset tracking, patient and staff tracking and workflow. The cumulative benefits of these applications include capital expenditure reduction through better equipment utilization and reducing lost equipment, automating bed management systems for improved patient throughput, resource analysis for improved allocation and staff satisfaction and charge capture.

Once the goals of the intended RTLS system are defined, the criteria that will determine a suitable RTLS solution must be considered. The benefits and use cases provide the clear fingerprint for the requirements of the RTLS infrastructure. They include:

Accuracy and precision. To what radius of measurement can the technology accurately locate the tag and how reliable is the location information? When using an only-RF solution like Wi-Fi which passes through walls, there is always some uncertainty about the tag's true location. That translates into an area of uncertainly of as much as 30 feet, and a confidence level of perhaps 70 percent of the time. This uncertainly may be acceptable for simple equipment tracking applications, but unless the solution can deliver 100-percent accuracy nearly all of the higher level benefits of RTLS are not available. This limitation becomes even more pronounced in environments like the ED or PACU, where space is often segmented by bed or pod.

Installation and scalability. How will workflow be affected by the difficulty, cost and disruptive nature (especially in patient areas) of the installation, can it accommodate future structural changes, and will it maintain acceptable levels of performance under high densities of tags.

Flexibility. Can the tags accommodate a variety of needs, including adhesion to variable equipment surfaces and materials, programmable buttons and temperature sensing?

In addition to meeting performance criteria, solutions enabled by the ideal RTLS infrastructure must deliver measurable business benefits - the business case. As the record of business successes scored by hospitals has grown, and as RTLS technologies have matured and hardware price points have dropped, this has become less of a hurdle. Better asset management alone has been demonstrated to yield measurably significant cost savings. To this add the staff productivity gains that can be captured from the elimination of wasted equipment retrieval time (and particularly nursing staff time) or the faster availability of clean beds and the business case becomes even more compelling. In terms of a hard dollar return, currently the typical payback period is running from 12-18 months for asset management and faster for patient throughput improvement.

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To achieve the benefits of the use-cases healthcare facilities demand now and will need in the future, the RTLS must provide perfect room level and bay level accuracy. Since RF-only RTLS solutions like Wi-Fi, ZigBee and other custom-RF solutions penetrate walls, they cannot provide perfect room level locations. To overcome this limitation, some solutions have adopted a secondary technology that is constrained to a room. Ultrasound and Infrared are two commercially available options. In case of the ultrasound solution , the signal is sent from the tag to the microphone in a room that is in turn connected to the IT. In case of the infrared , a room identifier device emits an ID through an infrared signal (like an invisible light bulb) and the tag that receives the infrared ID transmits it back to the IT through RF communication. Whereas these solutions provide perfect room level location, the Infrared/RF solution also provides a less disruptive installation since all the room level devices are battery operated, thus eliminating the need for any wiring.

Consequently, a "best of breed" RTLS solution that incorporates complimentary technologies like Infrared and RFID delivers a level of precision and flexibility that is unequaled by any single competing technology. By harnessing these technologies within a blended solution, RTLS becomes an infrastructure, not just an application. That infrastructure can be adapted to fill a variety of tracking roles, tailored to the needs of multiple hospital departments The level of tracking precision can be drilled down to the sub-room level, through the creation of "virtual walls" within spaces such as ICU and EDs. Better still, Infrared/RF RTLS can be architected to an existing Wi-Fi backbone, and can be populated by battery powered room identifiers, which accelerates the installation process, eliminates rewiring, brings down the upfront expense, and introduces "plug and play" functionality.

The hybrid technology RTLS solution, using a combination of advanced Infrared which does not penetrate walls, and active RFID represents the optimal solution for facility environments like those in healthcare, where staff, patients, and objects are continually on the move, in and out of changing environments. But first, last and always, the RTLS solution must address the pain points in clinical services and biomedical today – and the host of applications that it will be expected to address tomorrow. Regarded as an infrastructure, RTLS can act not only as a tracking tool, but can grow into a sophisticated analysis and workflow improvement technology as well. **JHIM**

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