



## The Batteryless RFID Imperative in Healthcare

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*“I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be.” - William Thomson (also known as Lord Kelvin), Scottish Physicist, 1883.*

### Introduction

At the same time as Lord Kelvin wrote these words, Heinrich Hertz, a German professor, was on the threshold of discovering the existence of electromagnetic waves - this was the birth of Radio. Today, for as little as 7.9 cents per tag in quantities of 5 million units, one can obtain Radio Frequency Identification (RFID) tags that *need no batteries and can report their unique identity to a reader 50 feet away*. What does this mean? Simply put, batteryless (also called passive) tags enable the rapid and precise measurement of almost every operation in the healthcare setting - from *counting and verifying* the number of items in each surgical tray to *understanding the calculus of human behavior* in hygiene compliance. Think about this for a moment. I'll wait.

In this article, I make following three claims. First, batteryless RFID is the most economical way to measure a large number of parameters in healthcare settings. I will illustrate this claim with several examples. Second, batteryless RFID, owing to its low cost and complexity, enables innovative patient-centric applications that would otherwise not be implemented. Finally, I will claim it often makes sense to implement batteryless RFID applications first.

### Background

With a decrease in hospital profitability in 2008 and 2009, increasing healthcare costs, and fewer hospitals due to consolidation, hospital administrators are challenged with finding new ways to run their organizations more efficiently. Materials managers are being asked to find

ways to improve asset utilization and reduce equipment expenditures, clinicians are asked to improve patient throughput in order to reduce unnecessary wait times, and IT departments are asked to implement future-proof, secure networks and applications to streamline complex workflows, automate processes, and address emerging requirements such as EMR - all while seamlessly delivering the best patient care possible.

New technologies have often been leveraged by hospitals to address these and other efficiency, safety, and patient care concerns. For example, hospitals were early adopters of wireless technology to establish mobile communication networks, driving the use of laptops, PDAs, Voice over IP (VoIP) phones, and other mobile devices. More recently, hospitals have been a leader in deploying real-time visibility solutions, enabled by auto-identification technologies like radio frequency identification (RFID).

RFID technology helps hospitals answer the most fundamental questions of knowing who and where its patients and resources are. With this data, hospitals can enhance a number of processes related to asset management, patient tracking and throughput, inventory control, patient-centric services, and infection control. The data delivered by RFID-enabled systems can also be used to support compliance with industry mandates and regulations including Sarbanes-Oxley, JACHO and OSHA. However, with the wide variety of applications and departmental functions that can be supported by an RFID-enabled visibility solution, selecting the right one, or even the right place to start, can be a daunting task for a hospital administrative and support staff.

### The Early Role of RFID

The initial excitement over the use of RFID technology to improve hospital processes in the area of asset tracking and mobile asset management began in earnest several years ago. This excitement was primarily garnered around the use of Wi-Fi standard based Active RFID tags that could utilize the existing WLAN (wireless local area network) that had been installed in hospitals for voice and data services. These Wi-Fi (or Active RFID) tags could be used to identify the location of expensive portable medical equipment in real time, reducing the time employees spent searching out equipment and, when combined with the proper management software that could accurately track equipment status, could actually improve

asset utilization. With improved asset utilization and management, the hospital could reduce its ongoing investment in such equipment.

This compelling idea of further utilizing the existing Wi-Fi network was attractive because it would provide additional cost benefit to hospitals on the use of their existing infrastructure investment beyond their original goal - which was to provide a mobile wireless local area network connection in the hospital for computers that did not require new physical Ethernet cable.

There is no doubt that Wi-Fi based real-time location solutions have the proven capability of delivering benefits to hospitals that have invested in a wireless infrastructure robust enough to provide the desired location accuracy of mobile assets and personnel. While many hospitals have invested in Wi-Fi infrastructures for use with their voice and data processing needs however, few may have the necessary density of Wi-Fi access points necessary for accurate real-time location tracking. Thus, for some hospitals, implementing a new Wi-Fi-based visibility solution can present a significant cost challenge driven by the need to expand their existing WLAN infrastructure. In addition, even with the necessary Wi-Fi coverage, RTLS/Wi-Fi based tags may not be a fit for certain applications due to their large size, time-limited battery life, required periodic re-calibration necessary to maintain location accuracy, use limitations in high interference areas like radiology, and the inability for most RTLS tags to survive the high temperatures and chemicals used during sterilization processes like those necessary for surgical applications.

These and other issues must be considered by hospitals when it comes to selecting a scalable and cost effective visibility solution. As a result, some healthcare organizations are researching alternatives to enterprise-wide RTLS systems and seeking solutions that address specific critical departmental processes while limiting impact to the existing IT infrastructure.

#### Proposed Solution: Implement Passive RFID First

While achieving material/equipment control objectives and lowering costs via the use of multiple RFID technologies is a viable opportunity, in today's economic environment, one must take into consideration the cost impact of significant changes in infrastructure and extensive hospital IT staff involvement.

In order to limit infrastructure impact and contain costs, one proven approach for hospitals to consider is to start with low cost and easy to implement Gen2 Passive RFID first. Gen 2 passive readers and tags utilize the existing data processing network infrastructure and, in many cases, do not require extensive IT staff involvement to deploy. By utilizing lower cost, easy to deploy passive RFID-based systems as the initial step, hospitals can significantly improve productivity, offer enhanced patient services, and improve quality of care within current budget and IT program restraints – while knowing that they have invested in a platform for growth.

Passive RFID readers can be deployed in a variety of ways including permanent installations wired to the existing hospital network, within strategically located “portals”, and integrated into other mobile and stationary devices. This flexibility is complemented by the wide variety of Passive RFID tags that can be affixed to or integrated into consumable inventory, handheld surgical tools, metals and liquids, patient wristbands, photo ID badges, and many other items. This variety of reader and tag combinations allows hospitals to select a single or a small number of areas to deploy a Passive RFID visibility solution – based on their immediate need - and expand as additional resources become available and critical needs are identified.

For example, by starting with just a single cost effective, easy to deploy RFID portal, hospital departments can address any number of closed loop processes under their own management and budget. This approach allows a hospital department to measure and manage asset, material, patient and/or staff flow and productivity through each critical stage of the process and has been proven to deliver a near-immediate return on investment. Other examples of critical processes and that can be addressed with Passive RFID portals or other Passive RFID enabled solutions include:

#### Operating Room Loss Prevention

In an operating room, small, expensive surgical instruments like probes have the potential to be lost within bulky bed linens and scrubs sent to the laundry or the trash. Easy to deploy Passive RFID-enabled loss prevention portals can be mounted on walls, placed in doorways, or directly in front of a laundry shoot. These portals are designed to eliminate unintended disposal of expensive medical equipment and have been proven to save hospitals thousands of dollars within months of being installed.

### Surgical Tray and Instrument Track & Trace

Pre-prepared trays, kits, and carts are used to organize and store a variety of instruments needed for surgeries. While preparing an operating room (OR) for surgery may seem to be a routine process, missing surgical equipment or the lack of pre-op and post-op supplies can have significant negative impact on staff and patient scheduling. The use of strategically placed Passive RFID readers to track surgical trays and manage the number of instruments within a tray or kit can ensure the right instrument is in the right place at the right time, resulting in increased patient throughput and reduced costs related to OR rescheduling.

### Patient Tracking/Throughput

The combination of Passive RFID-enabled badges, wristbands and readers are an effective solution for tracking patients, including those needing specialized procedures, high-risk patients, elderly patients who wander and become disoriented, and others who need important safeguards. Patient location information captured by Passive RFID readers can be integrated into workflow applications to enable automatic patient tracking throughout the care processes.

### Infection Control

Most hygiene compliance programs suffer from inadequate monitoring and lack of effective process control. As an extension of a Passive RFID reader infrastructure, hospitals can implement an automated method of capturing hygiene activities including the unobtrusive identification of staff member hand washing practices. When coupled with motion or other sensors, a Passive RFID system can interface directly to automated disinfectant dispensers, allowing staff members, managers, and other personnel to identify effective practices and provide reporting for compliance.

### Inventory Control

RFID technology has great potential to significantly reduce costs while improving materials management and inventory operations hospital-wide. Accurate management of the hospital supply chain – from scheduling through discharge – is essential to improving charge capture. A Passive RFID-based inventory control solution can provide real-time data on inventory availability and use as items move from storage to individual departments and ultimately to the clinicians and patients who use them.

### In-Transit Inventory Management

Extending departmental asset visibility, Passive RFID system can also be integrated into vehicles such as ambulances to identify what equipment is on board, improve inventory management, and facilitate regulatory compliance. In addition, a Passive RFID solution allows ambulance management companies to track high-value fleet equipment like portable radios and laptop computers and can be integrated with global positioning systems (GPS) for extended fleet management capabilities.

Data gathered from automating the use cases mentioned above helps hospital management continuously improve the activities associated with asset preparation and use, workflow, patient throughput, and productivity. Proven benefits delivered by Passive RFID systems include:

- Increased equipment availability
- Increased patient throughput and reduced wait time
- More efficient communications and utilization of transport staff and equipment
- Identification of bottlenecks that can lead to delays
- Improved quality of patient care and satisfaction
- Data, management reports ,and analysis that support continuous improvement

Providing additional utility, Passive RFID extends beyond implementing fixed-location readers. Because of the small form factor and ease of integration of embedded RFID readers, many suppliers to the healthcare industry are integrating Passive RFID directly into a variety of carts, cabinets, and room-based patient centric solutions for bedside medical data collection and device connectivity. Adding Passive RFID capabilities to application specific devices offers a significant opportunity for facility-wide workflow and process automation.

### Passive RFID in Action

An example of this approach is in motion at The Greenville Hospital System University Medical Center. The Center spans five hospital facilities, with 1,100 beds and 32 surgical suites across 90,000 square feet of physical facilities. Each year, Greenville performs over 33,000 inpatient and outpatient procedures, incurring about \$52 million in expenses, or about half the total for the entire system. At this size, it was not uncommon for expensive surgical instruments and other equipment to be misplaced or lost, so Greenville Hospitals' materials

services group sought to minimize asset loss and reduce the time spent locating OR materials. And though a wireless network was in place, John Mateka, Executive Director of Materials Services, determined it was insufficient to meet the hospitals' entire asset tracking needs.

Seeking a solution to address the specific issue of lost items in the OR, Mateka began working with software solution provider IBSS, Passive RFID Reader manufacturer ThingMagic, and the Industrial Portals Division of Jamison Door. The immediate result of this engagement was the deployment of Passive RFID enabled loss prevention portals designed for the operating room trash carts to pass through, prior to exiting the OR. The installation has proven highly successful resulting in the avoidance of the loss of many expensive surgical items like a \$19,000 electronic neo-probe.

In a second phase of Passive RFID deployment, Greenville Hospital is deploying Passive RFID readers throughout its main facility to track nearly 5,000 pieces of mobile medical equipment. Next steps for Greenville will be to look at other ways to leverage the existing infrastructure and further improve patient care and safety in the hospital. Overall the project is considered a big success. In fact, given the hospital's labor savings, loss prevention, physician satisfaction and improved productivity, Mateka expects a return on investment within one year. "Time saved and increased productivity are significant advantages of this system. Since we implemented the system, no tagged devices have been lost in the trash. Eventually, we also expect to be able to reduce our equipment purchases through a combination of reduced loss and our utilization history reporting," he said.

And as further proof of the success of this approach, Greenville Hospital received a "Surgical Innovator Award" from Healthcare Purchasing News for its June 2009 installation of Gen2 Passive RFID technology for tracking operating room devices.

Finally, Passive RFID enables innovative patient-centric applications that would otherwise not be implemented at all. At the new Roy and Patricia Disney Family Cancer Center in Burbank, CA, ThingMagic RFID readers embedded in the walls read patient badges and use this information to retrieve patient information in order to enhance the patient experience. This information includes patient preferences to activate custom hospital room settings - music,

lighting, temperature, etc. - and location data that are sent to staff phone displays, allowing clinicians to greet or locate patients quickly.

“I walked through these doors and I swear it was like angels singing. I’m not a really spiritual person, but this is so beautiful the way it puts you at ease by diverting your mind from your treatment and using nature to help you relax,” said Julie Stevens, Disney Family Cancer Center’s first patient. “When I was treated at the hospital, I would ignore the scary room. I would close my eyes and put my mind in another place,” she said. “I don’t have to do that here. They take me to that place.”

At its 8th Annual RFID Journal LIVE! conference, *RFID Journal* named the Disney Family Cancer Center winner of the 2010 Most Innovative Use of RFID award. This is a shining example of technology being so invisible that there is no interface to learn, batteries to replace, or behavior to change. The technology blends in with the environment, and creates experiences that would otherwise not have been economically feasible.

### Summary

I set out by making three claims. First, Passive RFID is the most economical way to measure a large number of parameters in healthcare settings. Second, Passive RFID, owing to its low cost and complexity, enables innovative patient-centric applications that would otherwise not be implemented. Finally, it often makes sense to implement Passive RFID applications first. If I have succeeded in illustrating these claims, you, dear reader, are already imagining how to take advantage of this low-cost, high-performance technology. I would welcome hearing your ideas, and perhaps collaborate on enhancing the patient experience, or making healthcare settings safer or more efficient. Just add imagination!

For more information, visit [www.thingmagic.com](http://www.thingmagic.com)

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