Executive summary

Healthcare facilities use radio frequency identification (RFID) and real-time location systems (RTLS) to identify, locate, track, and monitor patients, visitors, staff, assets, and equipment. These technologies improve safety, enhance the quality of care, reduce financial waste, and foster patient satisfaction. This white paper provides guidance on how RFID and RTLS benefits can be leveraged through integration with security control and monitoring systems.
Introduction

Healthcare facilities are challenged with caring for an increased number of patients and addressing their medical issues while still trying to save money and resources. As a result, medical professionals find themselves relying more on new technologies to help address the gap between the limited hours in the day and the workload that needs to be addressed.

Radio frequency identification (RFID) and real-time location systems (RTLS) technologies are now being deployed to ensure the safety and security of the most vulnerable patients, such as infants, the elderly, and those with mental illness. These technologies provide healthcare facilities with the ability to identify, locate, track, and monitor patients, visitors, staff, assets, and equipment. Typical return on investment for RFID/RTLS projects is 1 year or less. Value is maximized for both patients and the healthcare facility when this technology is integrated with the facility’s security, energy, building and power solutions.

Benefits include peace of mind, mitigation of risk, and the ability to track and monitor people and equipment. This, in turn, contributes to attainment of the larger goal of a safe and secure environment.

Healthcare facilities are only just beginning to utilize RFID and RTLS. In fact, North America currently leads the world in adoption of these technologies (see Figure 1), but these systems are installed in only an estimated 15% of North American healthcare facilities.

Defining RFID and RTLS

RFID and RTLS utilize radio waves to locate and identify items and people that have “tags.” The tags, which contain electronically stored information, can be as simple as an adhesive stripe or can appear as a more complex device incorporating radios and VoIP capabilities.

A simple definition

- RFID typically uses “passive” tags, which means a scanner or reader is needed to extract the information from the tag.
- RTLS typically uses “active” tags, which means that a radio in the tags remotely transmits its location to the system.

Figure 1

Projected (2018) RFID usage in healthcare industry by geography

In either case, a wireless, non-contact system uses radio frequency fields to transfer data from a tag attached to or embedded in an object that automatically identifies and tracks that object.

**RFID**

RFID helps hospitals identify objects, locations, and people through the remote use of radio waves. Simple RFID devices use an identification system, such as serial numbers, to track and manage objects. Other more sophisticated RFID systems, such as the kind used in operating systems, have built-in sensors that communicate data on location for identification purposes and on environmental conditions.

**RTLS**

Extending the benefits of RFID, RTLS is used to identify and track the location of objects and people in real time, typically within a building or other contained area. The RTLS physical layer usually consists of some form of radio frequency, but some systems use optical (infrared) or acoustic (ultrasound) technology instead of or in addition to radio frequency. RTLS provides real-time tracking of people and physical assets with more precision, higher granularity, and a greater level of accuracy than RFID or other identification systems.

RTLS uses active or passive transponders and readers to identify and locate assets, equipment, patients, and staff. In systems with passive tags, the RTLS transponder has no power source and cannot broadcast a signal. Systems with active tags have transponders with power sources that broadcast a location signal to the reader. The readers are sometimes referred to as interrogators, because they collect, interpret, and transmit data.

RTLS has a software component that manages the application, providing information on the status of tags that are attached to the assets, equipment, patients, and staff. The software shares information with other security, safety, building management, and power control solutions within the facility. RTLS also uses middleware to interpret, filter, and sort the data. These systems can generate reliable and effective data to improve safety, security, and hospital efficiency, with a quick and documented return on investment.

As an example, a healthcare facility can leverage RTLS to optimize utilization rates on existing medical equipment and supplies. This reduces the volume of purchases and increases the ability to document and capture the appropriate governmental and insurance billing requirements.

The design and installation of RFID and RTLS involves several technological components, including:

- **Transponder**—often referred to as the “tag.”
- **Reader**—sometimes called an interrogator, is a computer for interpretation and transmission of data.
- **Antenna**—for the transponder and the reader—either internal or external.
- **Middleware**—software that supports the solution, interpreting and filtering (sorting) the data for the control solution.
- **Software**—in a variety of formats, which manage the application, provide data to the end-user and communicate with other safety, security, building management and power control solutions.
The application of RFID and RTLS technologies can add value throughout a healthcare facility. Below is a list of important application areas:

**Improving patient and staff safety**—RFID and RTLS improve safety by preventing patient elopement (e.g., a patient who might wander off unnoticed) through integration with access control, video surveillance, and other electronic security and building technology. Not only are patients and staff safer, but in many cases facilities are also realizing lower insurance costs. Typical RFID and RTLS applications include access control, emergency response, infant protection, patient management, and enhanced video surveillance.

**Enhancing quality of care**—Facilities can also streamline and improve the quality of patient care by increasing efficiencies through reduced time and costs spent in locating assets, equipment, patients, and staff. Hospitals can implement RFID and RTLS applications for asset and equipment tracking and utilization, inventory and laundry management, and loss prevention. In fact, according to a recent study by Transparency Market Research, of all the applications where RFID is used in a healthcare setting, tracking medical hospital equipment accounts for the largest revenue generating application (see Figure 2).

![Figure 2](image-url)  
*Expected growth of market value for RFID / RTLS usage in tracking medical hospital equipment*

**Reducing financial waste**—With RFID and RTLS, organizations experience less theft, and equipment hoarding, as well as reduced rental and “late return” fees for important hospital equipment. Improved asset and equipment visibility leads to improved utilization and often results in a ROI of less than a year, especially for the RTLS technology. Applications in this area include anti-counterfeiting, product authorization, and bed and operating room management.

**Promoting greater patient satisfaction**—Providing the very best in care and customer service to the patients, visitors, and staff improves overall patient experience and outcomes. Hospitals that use an RTLS often find that their Press Ganey scores (patient satisfaction survey score), increase because of the benefits of the technology.

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The scenario below highlights specific cases in which RFID and RTLS could be used to enhance healthcare applications and the patient experience during outpatient surgery at a hospital.

7AM—A patient arrives at the hospital for outpatient surgery and receives a patient identification tag. The patient’s wife also receives a visitor tag. Now both the patient and his spouse are identified in the hospital information and security systems.

8AM—The patient enters the surgical pre-op area to meet the medical team and prepare for surgery. At this time, medical devices (assets) in the patient's room are aligned with his patient number so an accurate assessment of available technology can be made. At this time, any charges for the use and application of equipment or medical supplies can be applied to the patient’s chart and billing.

9AM—The patient enters the operating room for his procedure, and his wife enters the waiting room where she can monitor his status through the hospital’s automated messaging system. She can monitor and receive this information throughout the hospital complex. In the operating room, all of the technology is assigned to the patient, and the billing system accumulates the usage information for insurance and medical reports. Meanwhile, the inventory system analyzes the usage data for re-ordering, when available supplies dip below a set threshold point.

10AM—The patient’s surgery is complete and he is sent to the recovery room while his wife is located through the system and notified that she can now join him.

11AM—The patient is ready for discharge from the recovery area. The system accumulates the final data for the insurance, billing, and medical reports, the patient summary and discharge report, and the medical equipment/supply usage report. The nurse collects the patient and visitor tags from the family and they leave the hospital.

The RFID and RTLS solution above is used to identify, locate, monitor, and track all information pertaining the patient’s hospital visit. It is designed to improve hospital efficiency and patient satisfaction, reduce costs, and above all protect the patient and his spouse.

The example above illustrates for RFID and RTLS can integrate with the hospital’s access control, video surveillance, alarm systems, building management, inventory management, information systems, Wi-Fi infrastructure, and other sub-systems to:

- Identify medical technology, equipment, and supplies by treatment zone (in this case: the pre-op, the operating room, the post-op, and the recovery zones) and match them with the patient and the planned procedure.
- Provide immediate information on the patient, his wife, and any visitors and staff in case of an adverse event.
- Provide the proper environmental and power requirements for the planned procedure, as well as specific requirements of the medical and clinical caregivers.

The solution can be further highlighted by two functions:

- Assets—it knows where the assets are to increase utilization, ROI, control, and compliance.
- People—it knows where the people are to provide a safe, secure, and welcoming environment.
Almost every hospital security and safety team wants to create an identifiable and repeatable process that protects patients, staff, and visitors while improving care. Like many solutions, such a process is critical to the successful design and installation of RFID or RTLS technology. Below is a four-step process designed to help healthcare security leaders successfully implement RFID and RTLS.

1. **Identify key issues and objectives.** The first step is for the healthcare organization to clearly identify and define security and safety issues and then set goals to help address those issues. While this sounds simple, getting your organization to agree on these fundamental concepts can be daunting. To design a successful solution, however, it is important to gain acceptance and compliance from all key areas of the hospital that will be affected. Therefore, the team spearheading this process must analyze both the issues and intended outcomes for each of the affected workgroups to develop the best possible solution and implementation.

2. **Plan carefully.** A site survey and Wi-Fi network planning are critical to a successful implementation. Consultants can analyze the Wi-Fi network in place for the strength of signals, interference, and need for more focused and finite read ranges. Executing this step carefully will help ensure the best installation and optimal use of the system to meet intended goals.

3. **Set clear expectations.** The next step involves setting clear expectations as to the solution performance and output. At this point, services from any integrator or vendor involved in the process should be well documented and agreed upon before the work proceeds. This step helps avoid assumptions during the planning, design, and installation phases.

4. **Incorporate training.** Users of the new solution must commit and participate in the training of the technology to achieve the best system performance and highest potential expected outcome. It is vital to the process that the users have a comprehensive understanding of the issues and the value the solution brings to the healthcare organization.

As healthcare organizations continually work to provide better and more efficient healthcare to their patients, RFID and RTLS can assist in a variety of applications to help streamline processes, reduce human error, and speed billing times. The applications include:

- Access control-enhanced
- Anti-counterfeiting / product authentication
- Asset and equipment tracking / utilization
- Bed / operating room management
- Document / file management
- Emergency response
- Environmental conditions monitoring
- Expiration date monitoring
- Hand sanitization monitoring
- Infant protection
- Inventory management
- Laundry management
- Loss prevention

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Conclusion

It’s clear that integration to current and future solution tools can provide healthcare security, IT, facilities, and clinical leaders with a seamless flow of information to enable financial and operational decision making—all the while supporting the life saving mission of the healthcare facility.

Healthcare facilities that are considering an RTLS solution should be aware that for 48% of organizations, it takes 1 year to evolve from RTLS solution research to actual purchase. A thorough analysis of your healthcare facility will help to identify the most appropriate RTLS applications. Decision makers should keep in mind that solutions should be evaluated on their integration capabilities across security, energy, building, energy, and power systems, as this will more fully leverage hospital efficiency, productivity, safety, and financial health.

With the utilization of RFID and RTLS, healthcare management can benefit from advanced and comprehensive solutions that protect and safeguard patients, visitors, staff, assets, and equipment, with a measurable ROI.

About the author

Steve Nibbelink, CHPA, is the Global Director for Healthcare Security and RTLS Solutions for Schneider Electric. He currently serves on the Board of Directors for IHSSF (the International Healthcare Security & Safety Foundation), is a recipient of the 2011 IAHSS President’s Award for Outstanding Contributions to Healthcare Security & Safety

References

