

RFID-Enabled Asset Tracking for Large-Scale Healthcare Warehousing

Real-Time Visibility and Location Intelligence Across
Multi-Facility Operations

Healthcare Supply Chain Technology

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Figure 2 – Rack Scanning Architecture and Handheld Asset Search Workflow

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Executive Summary

Healthcare supply chains depend on accurate asset tracking to maintain operational efficiency and ensure that critical medical products are available when needed. However, large-scale warehouse environments often struggle to maintain accurate inventory visibility when assets are frequently moved across shelves, racks, and buildings.

A major healthcare organization in Virginia faced this challenge while managing more than 12 million medical assets distributed across four warehouse facilities. Due to frequent movement of products between shelves and storage locations, warehouse personnel struggled to determine the precise location of inventory items. As a result, locating a specific asset often required extensive manual searches that could take hours or even days, significantly impacting operational productivity.

To address these challenges, the organization implemented a comprehensive RFID-enabled asset tracking system capable of automatically monitoring asset movement across multiple facilities. The solution integrates RFID infrastructure, mobile scanning technologies, intelligent warehouse management software, and enterprise system integration to automate asset identification and location tracking.

With this system in place, staff can determine the last known location of any asset across multiple buildings, reducing asset search time from days to just minutes while significantly improving overall inventory visibility.

1. Introduction

Healthcare distribution centers manage vast inventories of medical supplies, equipment, and consumables. Ensuring accurate inventory tracking across large warehouse environments is essential for maintaining efficient supply chain operations and supporting healthcare delivery.

In this case, a healthcare organization operating four large warehouse facilities in Virginia needed a scalable solution capable of tracking over 12 million individual medical assets. Products were routinely moved between shelves and racks throughout the warehouse environment, making it difficult for staff to maintain accurate location records.

Without automated tracking technology, locating a specific asset often required manual searching across multiple racks and buildings. These searches could take substantial time and sometimes failed to locate the asset altogether.

Most importantly, it took a worker an average of 10 hours to scan the content of an entire 5 shelf rack. Hence, maintaining accurate inventory count in ensure inventory readiness was also a problem.

To improve asset visibility and streamline warehouse operations, the organization implemented an RFID-enabled asset tracking solution capable of automatically monitoring asset movement and providing real-time inventory visibility.

2. Operational Challenges

Prior to implementation, the organization faced several operational challenges.

Frequent Asset Movement

Products were frequently relocated between shelves, racks, and storage zones as part of normal warehouse operations. These movements were not always immediately recorded in inventory systems.

Limited Asset Visibility

Because location updates relied on manual processes, warehouse staff often lacked reliable information regarding the current location of inventory items. In some cases, it could take approximately 10 hours for a staff member to manually count the assets located on a single 5 shelf rack.

Multi-Building Complexity

Assets were distributed across four warehouse facilities, making it difficult to determine which building contained a specific item.

Time-Consuming Asset Searches

Warehouse personnel often spent hours or days searching for assets that had been moved from their previously recorded location.

3. Solution Overview

To address these operational challenges, the organization deployed a comprehensive RFID-enabled asset tracking solution designed to provide automated identification and monitoring of assets across the warehouse environment.

The solution integrates several core technologies including RFID gateways for printing regular and on-metal RFID tags, fixed RFID readers for monitoring transit points and exit doors, RFID handheld readers for mobile scanning and asset location, mobile RFID readers mounted on a custom scanning cart, and RWS Warehouse Management Software for centralized asset visibility and ERP integration.

Together, these components create a unified system capable of automatically identifying assets, capturing asset movement events, and synchronizing inventory data across multiple facilities.

4. RFID Tagging Infrastructure

The deployment began with the implementation of a comprehensive RFID tagging infrastructure. RFRain provided RFID gateways and SATO printers capable of generating

both standard RFID labels and specialized on-metal RFID tags suitable for medical equipment and metallic surfaces.

High-performance RFID tags were selected to ensure maximum read range and reliable detection across warehouse environments. Each tagged asset receives a unique RFID identifier, allowing it to be automatically detected and tracked throughout the warehouse lifecycle.

5. RFID Reader Infrastructure

To monitor asset movement across the warehouses, fixed RFID readers were installed at key locations including doorways, transit corridors, and inter-warehouse transfer points.

These readers automatically detect RFID-tagged assets as they pass through monitored zones. Each detection event is recorded and transmitted to the centralized warehouse management platform, providing real-time insight into the last known location of every asset.

6. High-Speed Rack Scanning Using a Mobile Cart

To further improve inventory visibility, a custom mobile scanning platform was developed. A modified golf cart equipped with a 28-foot RFID scanning mast allows warehouse personnel to quickly scan entire storage racks.

This mobile system can scan the contents of a five-shelf rack in approximately 10–12 seconds, enabling rapid verification of inventory across large warehouse areas. The scanning results are transmitted directly to the warehouse management platform, updating the last detected location of all scanned assets.

7. RFID Handheld Scanning and Mobile Application

Warehouse personnel were equipped with RFID handheld readers integrated with the RFRain Mobile Application. These handheld devices enable staff to scan pallets during receiving and shipping operations, verify pallet contents against expected inventory, locate specific assets within rack rows, and perform targeted searches for misplaced items.

The mobile application automatically compares scanned pallet contents against inventory data stored in the organization's Microsoft Dynamics 365 ERP system.

8. Warehouse Management Platform

All RFID data is processed through the RFRain Warehouse Software (RWS) platform deployed in a secure cloud environment.

The platform collects RFID read events from readers and mobile devices, maintains a centralized database of asset records and location history, provides asset search capabilities for warehouse personnel, and synchronizes asset data with the ERP system.

9. System Performance and Scalability

The RFID system was designed to support large-scale warehouse operations and high volumes of asset tracking events.

Key performance capabilities include processing up to 13,500 RFID events per second, providing near real-time cloud data access, and maintaining data transmission latency of less than 10 seconds.

10. Cybersecurity and System Security

Because the solution operates within a healthcare logistics environment, strong cybersecurity controls were implemented. The system runs on a Red Hat Linux infrastructure with SELinux security controls to protect the application environment and safeguard operational data.

11. Operational Results

Following deployment, the RFID tracking system delivered substantial operational improvements.

Warehouse staff can now determine the last known location of any asset across multiple warehouse buildings. Users can identify the building where the asset was last detected, the doorway or transit point where it was scanned, and the most recent rack scan containing the item.

As a result, the time required to locate assets has been reduced dramatically—from days or never locating the item to just a few minutes.

12. Conclusion

The deployment of an RFID-enabled asset tracking system significantly improved warehouse visibility, operational efficiency, and inventory accuracy.

By combining RFID infrastructure, mobile scanning technologies, enterprise system integration, and intelligent warehouse software, the solution provides real-time visibility into asset movement across multiple warehouse facilities.

With the ability to track over 12 million assets across four warehouses, this deployment demonstrates how RFID technology can deliver scalable, real-time asset visibility for complex healthcare supply chain operations.