How Cisco Tracks RFID with Active RFID and Wireless LANs

Active RFID tags and WLANs ensure compliance with corporate finance and government regulations.

Cisco IT Case Study / Wireless / Cisco RFID Solutions: Maintaining accurate information about the location of valuable equipment is a complex and ongoing requirement for any large enterprise. New technologies such as radio frequency identification (RFID) help streamline asset tracking and improve workflows for equipment procurement and logistics. This case study describes research that Cisco IT conducted to evaluate how well the Cisco wireless LAN could detect equipment with active RFID tags, and how well it could communicate data about equipment location over the wireless LAN to an internally developed asset tracking application. Customers can draw on Cisco IT's real-world experience in this area to help support similar enterprise needs.

> "The Cisco wireless LAN and active RFID tags gave us the near-real-time information on equipment location that we need for improved asset tracking."
>
> **– Sylesh Chandrashekar, IT Analyst, Cisco India**

BACKGROUND

Cisco® India is a research and development division that focuses on testing equipment, from Cisco and suppliers, in laboratory environments. This equipment is imported from other countries. As a member of the Software Technology Park of India (STPI), a government regulatory institution, Cisco can obtain a waiver of customs fees. However, STPI representatives can visit the Cisco India facilities at any time to verify regulatory compliance by conducting a physical audit of the equipment assets. In addition, the Cisco India finance division performs an annual audit to verify that all purchased equipment can be located within company facilities.

CHALLENGE

The Cisco India lab operations are spread across multiple buildings and locations. Equipment is often transferred between labs so that it can be used in different tests; it may also be sent to external vendors for calibration or other purposes. "At any given time, we need to be able to pinpoint where equipment is located, whether it is in a Cisco facility or it has been sent offsite," says Sylesh Chandrashekar, IT analyst, Cisco India. "However, the number of individual equipment elements that must be tracked across numerous lab locations makes it difficult to identify the location of an asset."

Historically, Cisco India's corporate assets were tracked by the engineering, logistics, and finance departments, each for different reasons. The engineering team is primarily concerned with tracking equipment so that it can be found easily for new tests. The logistics team is responsible for handling customs and import issues, as well as compliance with STPI rules. The finance team needs asset information to authorize invoice payments, and to complete the annual asset audit.

Each of these teams used spreadsheet files to manually track equipment data. These files quickly became outdated as equipment was moved without notification and as employees moved to new facilities. In addition, multiple spreadsheets for asset tracking meant inconsistent data and duplication of efforts.

There are costs associated with not properly tracking equipment assets. For example, penalties for noncompliance

with STPI standards can vary from a monetary fine starting at US$10,000 to potential imprisonment of company employees. Indirect costs are incurred from the inefficient and time-consuming task of manually entering data into the spreadsheets. And lack of knowledge about the current location of expensive equipment can mean lost time and productivity for testing engineers, as well as vulnerability to theft or loss. Cisco needed a central repository for maintaining up-to-date information on equipment location.

SOLUTION

To meet the needs of all Cisco India teams, the requirement was simple: maintain a single source of asset information that would identify the current location of each equipment asset. For Cisco IT, this requirement meant testing a wireless asset tracking solution with three parts:

• A Cisco radio frequency identifier (RFID) solution that combined active RFID tags with the Cisco wireless LAN to track the current location of equipment. The project team had previously determined that passive RFID tags would not be adequate for the dynamic Web environments, because those tags would require manual scanning for each equipment move.

• The element discovery and mapping capabilities of Cisco network management systems, to show asset location on a graphical floor map display.

• A central, internally developed database and application (called i-Secure), used for asset tracking by Cisco personnel involved in asset management and finance.

• Cisco RFID solutions converge tag-based information into the network, adding RFID as another data type to be secured, managed, and scaled based on intelligent networking.

The Proof-of-Concept Project for RFID

Cisco IT tested the proposed solution in a proof-of-concept project, conducted in two phases at Cisco India facilities (Table 1).

Table 1.   Testing Setup in Each Phase of the Proof of Concept.

Phase 1: Lab Environment	Phase 2: Office Environment
Covered an area of 6000 square feet in two labs; extensive presence of metal structures and radio interference from other devices	Covered an area of 50,000 square feet on a single floor; typical office environment
Tested active RFID tags from AeroScout	Tested active RFID tags from AeroScout and PanGo

 In both phases, the project team set up an independent 802.11b network using a Cisco 2700 Series Wireless Location Appliance, a Cisco Wireless LAN Controller, and Cisco Aironet® 1010 Access Points, monitored by a Cisco Wireless Control System on a separate server. The project tested active RFID tags from AeroScout and PanGo Networks, two companies that offer products compatible with Cisco wireless solutions.

Cisco IT studied deployment challenges and identified the best practices for full implementation of the wireless solution for asset tracking. Each phase also had specific objectives for testing (Table 2).

Table 2.   Testing Objectives in the Proof of Concept.

Phase 1 Objectives	Phase 2 Objectives
Validate that the following processes could be automated with the use of RFID and the new asset tracking application: • Gate passes and receiving workflow for handling equipment when it arrives at a Cisco India facility • Compliance with STPI rules • Asset assignment to individual labs and employees • Visibility of equipment location on the floor map display presented by the network management system	Evaluate the capabilities of the active RFID tags, the WLAN, the network management system, and the asset tracking application for locating equipment in near-real time. Identify lessons learned, best practices, and recommendations for full implementation of the wireless asset tracking solution within Cisco.

Using the Cisco WLAN

When the proof-of-concept project was conducted, the production WLAN in Cisco India was based on Cisco Aironet 350 Series Access Points. The project team determined that supporting active RFID would require a wireless infrastructure upgrade to implement the following products (Figure 1):

• Cisco Aironet 1100 Series Access Points, which support the Lightweight Access Point Protocol (LWAPP) for the data and location-based services necessary for wireless asset tracking.

• Cisco 4400 Series Wireless LAN Controller, which provides systemwide WLAN functions such as security policies, intrusion prevention, RF management, quality of service (QoS), and mobility.

• Cisco Wireless Location Appliance, which uses Cisco RF fingerprinting technology to simultaneously track thousands of active RFID tags and wireless devices to a proximity of a few meters.

• Cisco Wireless Control System, which offers tools for WLAN planning and design, RF management, location tracking, and intrusion prevention, as well as WLAN configuration, monitoring, and management.

Figure 1.   Typical Deployment of Cisco WLAN Components for Detecting Active RFID Tags
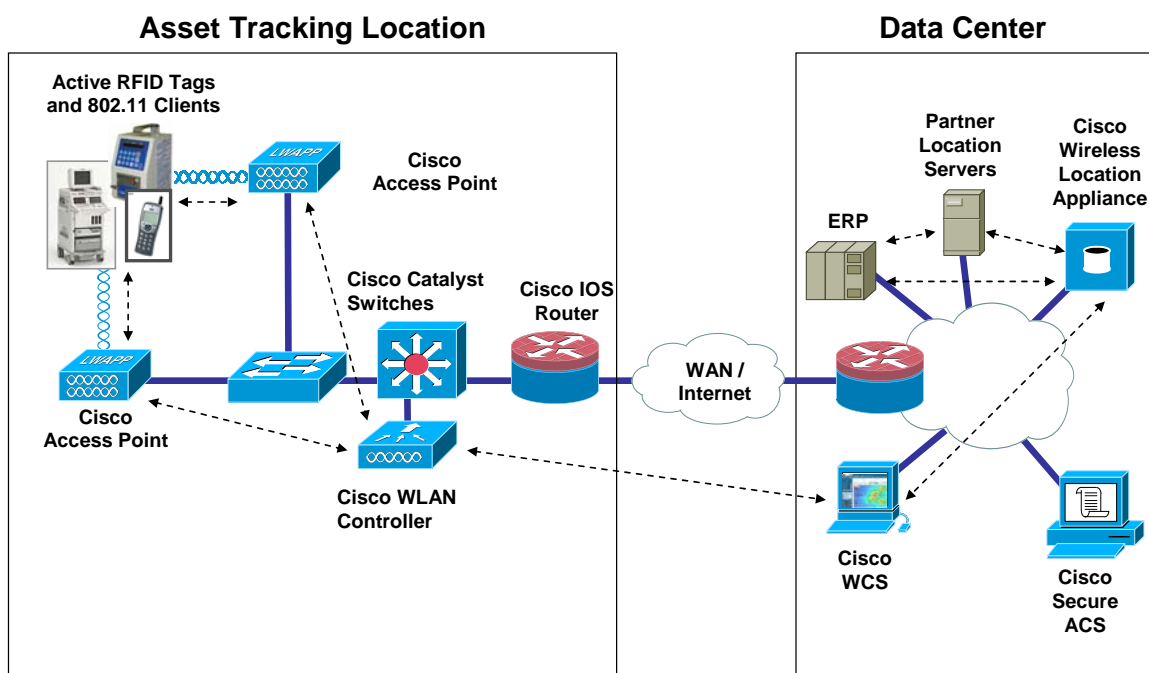
Because Cisco wireless networks treat RFID information as simply another data type, the Cisco Wireless Control System can detect active RFID tags and show the associated assets on a floor map display. Using the WLAN means that a line-of-sight signal is not required to read the RFID tag, and multiple tags can be detected simultaneously.

A New Database and Application for Asset Tracking

Concurrently with the proof-of-concept project, employees from Cisco India and Cisco IT participated in a cross-functional corporate effort to develop a central database and application (called i-Secure) for tracking corporate assets. The i-Secure tool provides features for asset tracking and workflows to help the logistics teams with functions such as auditing and regulatory compliance. Asset data is stored in a secure, central database that will be maintained in part through automatic detection of the active RFID tags by the Cisco WLAN.

"Logistics teams in other Cisco locations around the world have similar problems and requirements for asset tracking, importing activity, and regulatory compliance," explains Chandrashekar. "With i-Secure, we are defining a process to help these groups communicate with each other easily and create a single, accurate source of asset information."

The extensibility and scalability of Cisco i-Secure and the use of active RFID tags for wireless tracking of equipment assets makes it possible to use this tool globally. Data attributes and workflow definitions can be customized to meet the particular customs procedures, regulations, and business requirements in each country.

Although Cisco IT chose to develop its own database and applications, third-party products are available for asset tracking that integrate with Cisco wireless and RFID solutions. For example, the PanGo Locator Asset Tracking System and the AeroScout MobileView software are compatible with a Cisco based network infrastructure.

RESULTS

The Cisco India proof-of-concept project for tracking assets with active RFID tags confirmed that:

- The Cisco India WLAN infrastructure could be easily upgraded to support active RFID solutions while complying with Indian government regulations about wireless frequencies.

- Cisco could apply its existing investment in an 802.11 wireless network, the standard that is widely accepted in India, to the solution.

- The Cisco WLAN was able to read the active RFID tags and locate the asset within a radius of 3 to 4 meters, which is considered adequate for the needs of lab staff and the logistics and finance teams.

- The project also identified the following differences in the tested RFID tags:

- The AeroScout tags are not assigned an IP address and therefore do not need to support the authentication required by Cisco internal information security policies. However, these tags provided a wider proximity range for identifying equipment location.

- The PanGo tags provided a tighter radius for equipment location, but at the time of testing did not support authentication.

- At the corporate level, Cisco expects to realize the following benefits from wireless tracking of equipment assets:

- Streamlined logistics and asset tracking through the location-based services enabled by the WLAN and RFID solutions.

- Better control of high-value assets through data and alerts based on the location and movement of tagged equipment.

- The ability to use location applications and RFID tags from multiple vendors, as well as internally developed systems and databases.

- A central repository of asset information and a tracking application that can be used worldwide, yet comply with country-specific customs and regulatory requirements.

LESSONS LEARNED

Several lessons emerged during the Cisco India proof-of-concept project that are relevant to any enterprise interested in using RFID and wireless networks for asset tracking.

WLAN infrastructure. At the time of the project, the wireless infrastructure at Cisco India facilities was based on Cisco Aironet 350 Series Access Points, which do not support location-based services. A planned upgrade will deploy Cisco Aironet 1100 Series Access Points, which use LWAPP to deliver data and location-based services.

Access point placement. Appropriate placement of access points within the facility is vital to an effective wireless architecture and to proper RF calibration. Access point placement differs from facility to facility -- or even within a facility if there are variations in the floor plans, wall locations, or interior furnishings.

Access point radio angle. The placement and range of antennas, and how the radio signals are transmitted without overlapping, are important factors for obtaining accurate and consistent proximity data from a WLAN.

RF calibration. Proper calibration of RF signals is critical for enabling location-based services to deliver close and consistent proximity data. RF calibration must be performed carefully across all facilities and floors and repeated if the floor layout changes.

Tag configuration. PanGo tags are Wi-Fi clients and must be bonded to a valid Service Set Identifier (SSID). However, obtaining location data requires assigning an IP address to the tags. The project team resolved this issue by creating a virtual LAN that was configured with a SSID and 128-bit Wired Equivalent Privacy (WEP) for security.

Cisco Wireless Control System configuration. The project team used the Cisco Wireless Control System to configure wireless equipment with the correct parameters for obtaining a consistent, accurate read rate from the active RFID tags.

NEXT STEPS

Within Cisco India:

- Upload current asset data, then verify that data by conducting a physical audit of equipment located in each facility.
- Replace the spreadsheets with the Cisco i-Secure application for asset tracking.
- Develop processes for monitoring and managing the asset lifecycle.
- Implement a WLAN infrastructure upgrade in Cisco India facilities to support the necessary location-based services for asset tracking.

For other Cisco divisions:

- Provide information on lessons learned, best practices, and recommendations identified in the proof-of-concept project to the Cisco next-generation infrastructure team for global deployment of the RFID-based asset tracking system.
- Conduct additional proof-of-concept projects in Cisco labs and data centers located in other countries.
- Define the criteria that specify which assets will be tagged for RFID tracking in order to control costs.
- Define the technical criteria and select RFID tags for full project implementation.

Evaluate the RFID wireless solution and the Cisco i-Secure application for tracking equipment location in Cisco data centers.

FOR MORE INFORMATION

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NOTE

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