



Improved Logistics Tracking with RFID

Challenge

Active radio-frequency identification (RFID) technology is used to uniquely identify and track shipments important to military operations around the globe. This worldwide network consists of tags or transponders on containerized shipments of equipment and supplies, and readers (interrogators) on both fixed and mobile platforms around the world. Using this technology, commanders can use the Internet to obtain near-real-time updates on locations of shipments.

Older global interrogator networks, however, used RFID readers that only allowed for a fixed number of transponder IDs, limiting what tags could be “heard” by the interrogators. These products used proprietary technology and were unable to integrate with other vendors’ applications.

Solution

To mitigate the limited reading capability of the interrogators and establish interoperability, Pacific Northwest

National Laboratory (PNNL), sponsored by the Department of Defense (DoD) and in coordination with the North Atlantic Treaty Organization (NATO), transitioned the system to ISO/IEC standard RFID transponders and tags. This enabled the use of RFID tags from multiple vendors.

PNNL’s team of experts were able to establish interoperability of all the suppliers’ technology by developing a software architecture that allowed both DoD-developed and vendor-developed applications to seamlessly interact with all vendors’ products. This was accomplished by creating driver-based architecture with a middleware abstraction layer to enable smooth interoperability. PNNL’s novel architecture defined standard programming interfaces that connect sensor technologies, integrate data fusion/threat assessment algorithms, and connect command and control systems. A center for independent verification and validation for all the RFID products involved was created where testing is conducted to validate both compliance with the ISO/IEC 18000-7 standard and interoperability with all other fielded products.

Once the software architecture was defined and in place, PNNL's role shifted from one of development to one in which we provided technical support to vendors during their initial implementation. PNNL continues to provide independent verification and validation on new products vendors develop as well as on improvements of existing technology to ensure continued smooth functionality.

Impact

The compliant, interoperable system enables DoD/NATO to track shipments of important goods in near-real time throughout their global sensor network, leading to improved situational awareness. Further, this situation further validated the need for interoperability in situations where independent entities contribute pieces to an overall solution. To keep all contributors on a level playing field, a neutral third party is needed to implement software architectures that support interoperability and collaboration. PNNL's multidisciplinary teams lead this field of first- or one-of-a-kind solutions.

About PNNL

Interdisciplinary teams at Pacific Northwest National Laboratory address many of America's most pressing issues in energy, the environment and national security through advances in basic and applied science. Founded in 1965,



More about active RFID

The Active RFID system consists of strategically located interrogators (readers), transponders (tags), and a computer network. Interrogators periodically collect the universally unique ID's of transponders attached and associated with assets and or shipments in their immediate vicinity (~ 300 foot radius around the interrogator) and forward this information to the computer network for storage in a centralized database. Since the interrogator locations are registered with the computer network, this allows the system to provide the location of tagged assets during shipment or storage. Some transponders also include on-board sensors (temperature, shock, humidity, etc.) so that in addition to providing location, the transponders can provide asset state-of-health using on-board analysis and diagnostics algorithms. A web portal provides end users access to the active RFID system's information about their tagged assets.

PNNL employs 4,300 staff and has an annual budget of more than \$1 billion. It is managed by Battelle for the U.S. Department of Energy's Office of Science. As the single largest supporter of basic research in the physical sciences in the United States, the Office of Science is working to address some of the most pressing challenges of our time.

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