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RFID: Getting From Mandates to a Wireless Internet of Artifacts

Opinion by Rajit Gadh

OCTOBER 04, 2004 (COMPUTERWORLD) - Radio frequency identification research at UCLA suggests that in response to supplier mandates from Wal-Mart Stores Inc., the Department of Defense and others, the "slap-and-ship" model probably won't work when scaled up.

But for now, just slapping RFID tags on pallets and cases and shipping them seems to be the de facto option that most companies are pursuing because the deadlines for these mandates are rapidly approaching.

These mandates are forcing product suppliers into accepting solutions from their technology providers that may not be ready for scalable deployment. Technology providers, in the meantime, have been scrambling to provide solutions and integrate RFID capability into their products.

While there is much hype surrounding the mandates, product suppliers need to ask whether they can obtain benefits beyond the mandates. Today, product suppliers are not benefiting internally by their RFID deployments. Yet the mandates are forcing them to get their feet wet, and once they do, they may be willing to experiment beyond the mandates to see if additional benefits can be gained to provide a justifiable return on investment.

Technologically, as is now widely regarded, the excitement of RFID is due to its contactless communication, low cost of tags, batteryless operation and long life. On the business side, the excitement of RFID is due to its ability to keep track of any product from cradle to grave as it moves through the various stages of its supply chain.

For the product supplier, RFID can track in-manufacturing inventory, when and which products leave the factory floor, when products reached their customers and so on. Retailers such as Wal-Mart, Target and Tessco can, on the other hand, keep a very tight supply chain, holding inventories to a minimum by strict control on the flow of goods.

The incorporation of RFID into supply chains is going to result in major business process changes, especially for product suppliers. When an incrementally new technology becomes available, tweaking of business processes is often sufficient to accomplish the desired incremental benefit. However, when trying to inject a radically new technology such as RFID to an existing business process, generally neither the costs nor the benefits are incremental.

For the product suppliers, the incremental benefits of RFID would need to be attained subsequent to the first round of investment, or else the follow-on round of investment may become difficult to justify. Realizing a return on the first round of investment is going to be challenging because the current slap-and-ship model isn't of much benefit to the product supplier -- it addresses only the needs of the retailers' mandates.

However, after implementing slap and ship of RFID tags, the supplier and retailer may be able to team up and exploit RFID by reducing misplacement, pilferage, shrinkage and theft reduction along the supply chain. They could also manage point of sales, catch contraband shipments, manage returns of retail products, manage warranties and repairs, and track recycled goods. That may prompt the supplier to actively pursue RFID.

In addition to the business challenges outlined above, our experience with commercial reader and tag technology when used via pilot studies on the RFID Middleware (using WINRFID, which is the middleware layer developed in UCLA's Wireless Media Lab) is revealing that the hardware technology of today needs to be made more robust for industrially reliable and scalable deployments.

Environments where RFID needs to get deployed tend to be rugged with radio frequency-interfering material such as liquids and metal being part of the products being shipped. For example, cases containing metallic cans of tomato ketchup may not work effectively with generic passive tags.

Specialized tags and readers, radio frequency-planning-based locating of tags of cases and pallets, use of appropriate middleware and other things would be needed to provide the reliability and speed of reading necessary for effective compliance to supply chain mandates.

A thorough radio frequency-planning step in the actual production environment (assisted possibly by simulation software) will become a necessary step. Achieving seamless wireless connectivity between objects in nondeterministic environments that contain a variety of materials is expected to be one of the major technological challenges in creating industrially scalable RFID solutions.

Fundamentally, the first generation of high-volume RFID applications has primarily been about broadcasting an artifact's identity. Subsequent generations will have embedded information about themselves that they can selectively and intelligently communicate with other objects in their wireless neighborhood. This would essentially form what I believe is going be the wireless "Internet of Artifacts."

The Internet of Artifacts eventually will create electronic definitions of objects, allow objects to communicate and exchange information on identity-based actions, allow ad hoc artifact networks to be created and dismantled, allow inanimate objects of any scale to have an identity in an economical fashion, allow objects to announce when they have arrived, or, allow mobile objects to be tracked.

The transition from the current RFID technology to the Internet of Artifacts requires significant research and new infrastructure generation at several layers. The lowest layers would allow robust communication infrastructure among the artifacts. The middle layers would allow data exchange formats to be specified, coded/decoded, routed, tightly secured and so on. The upper layers would provide the business logic to drive the middle and lower layers.

The question that the RFID community needs to ask is whether the current architectures proposed by standards bodies are scalable at the level needed by an industrially robust Internet of Artifacts.
In collaboration with our industry partners, we are architecting and developing RFID middleware that will scale for industry's needs. UCLA's Wireless Internet for Mobile Enterprise Consortium (WINMEC) has put together an RFID advisory forum that provides thought leadership on RFID along with its member companies, and has been developing an RFID Middleware Layer solution to address the technology concerns of the RFID community.

At its RFID Forum on Oct. 12, WINMEC is presenting its plan to partner with industry in the implementation of practically realizable pilots as an immediate goal for the next year.

In three to five years, WINMEC would like to bring diverse enterprises and vendors to create consensus on interfaces, middleware and protocols, with the eventual goal to create "neutral interfaces" for a usable and scalable Internet of Artifacts. Eventually, I believe the current version of RFID is a primitive yet crucial first step in the creation of the massive and scaled Internet of Artifacts.

Rajit Gadh is a professor at the Henry Samueli School of Engineering and Applied Science at UCLA, where he heads the Wireless Internet for Mobile Enterprise Consortium.