ANALYZING THE RFID TAG READ RATE ISSUE

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In our recent Cutter IT Journal article titled "The Next Frontier: How Auto-ID Could Improve ERP Data Quality" (September 2004), we put forth a general definition of data accuracy that focuses on obtaining the correct value for a measurement at the correct time. In dynamic systems, timeliness is very important for data input into enterprise resource planning (ERP) because measurements of inventory and other values for business processes are constantly changing. The use of cycle counting and bar codes are important in achieving improved data accuracy and have contributed a great deal to the early success of ERP.

Practitioners are now looking to Auto-ID technology, currently implemented by EPCGlobal, as the next step toward improved data accuracy with the promise of increased volumes of data obtained through 1) greater granularity through mass serialization, and 2) the potential to blanket the supply chain with fully automatic read points. With this structure for gathering information, Auto-ID technology offers the potential to increase by an order of magnitude the amount, accuracy, and timeliness of data within businesses. Real-time streaming data, filtering, processing, and response all become possible.

Although Auto-ID is a promising technology and ultimately will provide ubiquitous tracking and tracing of individual items, its application in open industrial supply chains is in early stages. Consequently, many challenges in the application of the technology remain, particularly on the newest component of the system, the radio frequency identification (RFID) tags and readers. This was also the case during the early implementation of bar codes where read reliability was much lower than it is today. This was in part because excessive variability existed in printed bar codes and the scanners themselves.

RFID adds an additional layer of intricacy in obtaining an accurate read as compared to bar codes. Because bar-coding is a mature technology with 50 years of testing and development, conditions necessary for successful production and use are well understood. Further, because bar codes depend on optical means for a successful read, the technology is direct and understandable. As long as the correct conditions exist, read reliability should be high.

Yet with RFID, tags are coupled to readers via radio-frequency fields and waves that are invisible to the human eye. As a result, read performance can seem highly variable and sometimes difficult to predict because it is hard to visualize the properties of electromagnetic fields. In addition, environmental factors play a much larger role in negatively affecting performance as compared to bar codes. Materials surrounding or blocking tags, such as liquids and metals, can absorb and reflect the radio frequency energy. Humidity, not a factor in bar code reading, can significantly reduce the read range for RFID tags. A final complicating factor is that the manufacturing process for tags has still not achieved critical mass. In some cases, manufacturing imperfections lead to poor read reliability. This type of failure is independent of environmental factors influencing electromagnetic fields, and causes complexity in achieving high reliability.

Reliable and accurate reading of RFID tags is generally not a problem for a specific process if thorough testing and debugging is possible as part of the installation. However, in open system applications such as tracking an object throughout the supply chain, neither the applicator of a tag nor the integrator of a reader installation have direct control over a single implementation. The old model of deploying RFID is no longer applicable. Current research and development efforts are focusing on standardization and testing to improve tag and reader designs, thus overcoming the effect of environmental factors in achieving 100% read reliability.

During the path toward 100% read reliability, many companies are considering adopting an "inferred read" approach. By associating all items within a case to that case, or all cases on a pallet to that pallet, a successful read of some fraction of the aggregation can be used to represent a successful read of all objects in the aggregation. For example, if a full pallet contains 60 cases (each tagged), then a successful read of only one of the electronic product code (EPC) tags implies that a complete pallet has been read. The Auto-ID approach, where information is held on the network rather than in tags, is a great advantage in facilitating inferred reads. However, the inferred reads approach assumes that the aggregation is always intact (i.e., all items are in a case or all cases are on a pallet). This is a disadvantage when EPC data is needed for such management priorities as the reduction of theft or the automatic generation of pedigrees for the shipment of pharmaceuticals in the US.

Though intensive research efforts are currently in place, it still might be several years before near 100% read rates occur for tagged items.

To propel Auto-ID technology forward, there needs to be a coordinated effort to improve tag quality and read rates under a wide range of conditions within supply chains. Current research at the Massachusetts Institute of Technology (Cambridge, Massachusetts, USA) and other academic institutions gives some hints that changes in supply chain processes or the design of tags might provide a great advance in improving read rates. IT professionals should keep close track of these developments. When read rates improve and prices decrease, probably sometime before 2009, there will be an explosion in Auto-ID applications involving supply chains in the healthcare, pharmaceutical, telecommunications, aerospace, auto parts, and consumer goods industries. Preparation for this eventual development would be a wise strategy for those in industries where the properties of Auto-ID technology might offer significant strategic advantage over competitors.