

R RFID stands for Radio Frequency Identification and provides the capability to retrieve data via radio. A miniature device called a transponder, or tag, contains data, usually a serial number. The tag may respond to a signal emitted by an interrogator, or reader. Readers transmit a signal that activates the tag. When the tag is activated it responds by sending its data. The reader is just one step in the path the data takes once it leaves the tag. Most likely the data will be collected from the reader by a computer which will look up the serial number in a database or perform other processes, depending on the application.

Some tags have internal batteries (active tags) and some receive power from the interrogation signal (passive tags). Additional features may be added to a tag to make it capable of measuring a physical property in its environment such as temperature or pressure. For instance, a tag might be capable of reporting the maximum temperature to which it had been subjected. Tags come in many configurations and may range from passive devices containing minimal electronics, to powerful units incorporating sophisticated security features such as tamper indicators. Tags are designed to be read at a distance determined by their function. Some tags, such as those on package goods, are designed to be read at close proximity. Others, such as those used for asset tracking, may be designed to be read at a distance of hundreds of feet or even by satellite. The amount of data that can be stored in and read from a tag also varies with their designed function. Areas where one might expect to see RFID technology employed include retail, warehousing, logistics, healthcare, transportation, construction, financial services, agriculture, security, and defense. In fact, it is difficult to name an industry in which RFID could not find a use. The RFID market is currently more than \$1 billion, and is projected to reach more than \$2.1 billion by the end of 2005, primarily in retail, pharmaceuticals, consumer package goods and defense. RFID is currently used in a wide variety of applications including access control badges, toll road transponders, patient identification, tracking parcels in shipment, animal identification, real-time location systems, order management, vendor compliance, identification of counterfeit goods, and real-time inventory control. RFID tags may be embedded in currency and other financial instruments, tickets, passports, and pharmaceuticals to circumvent counterfeiting. They can be embedded in commodity components during manufacture. Materials similar in appearance but differing in quality or price may be better differentiated in the manufacturing process and handled differently by automated processes on the assembly line. Embedded in paper forms, they can facilitate document tracking. Embedded in animals

they can monitor movement, identify those ready for market, and aid in identifying sick animals. Uses in healthcare include tracking of surgical materials to verify removal from a patient. As a proximity device they can be used to monitor patients in a healthcare facility, verifying the correct drugs are being administered, and preventing infants from being kidnapped. A trade show and event management system could provide automatic attendance audits and lead retrieval. In a logistics context RFID may permit faster loading of trucks and shipping containers by reading contents of containers as they arrive, and with improved accuracy. When integrated with load management solutions, efficient loading of ships and trucks is facilitated. In a military context RFID technology might find use as part of a "smart warfare" approach, permitting the loading of ships in the optimum order for unloading at the battlefield, verifying the loading of essential materiel, and interfacing to battle scenario programs to suggest alternate strategies based on availability of needed resources. Airport security is already being assisted by RFID technology at some airports through the use of RFID-based access badges. As the cost of implementation declines, we will begin to see increased usage of RFID for baggage handling. RFID tags in air passenger tickets might enable locating passengers in the terminal area, to facilitate quicker parking access for frequent flyers and employees, and more secure passenger tickets. The sky is literally the limit for the possibilities of RFID technology in airports and transportation in general. There is much focus currently on RFID applications within the retail sector. Wal-Mart recently stated that they will require their top 100 suppliers to use RFID tags on cases and pallettes of goods received at its distribution centers by January 2005. The U.S. Department of Defense is requiring that all suppliers tag goods at the lowest possible level by the same date. This commitment to RFID on the part of Wal-Mart and the DoD should result in a proliferation of devices on retail packaging or actual products. RFID allows for much more data to be made available than does the widely used Universal Product Code (UPC). Data such as production lot, point of origin, and other information useful in tracking products could be made readily available. Low cost RFID devices on retail goods could make it possible to read an entire basket of goods at the checkout. Inventory management can be facilitated by integration with supply management software, permitting inventory to be entered into the system as it comes off the loading dock. "Smart Shelves" could monitor the quantities of items and alert staff of the need to restock.