PTT talk, you just press the button and are ready to talk immediately. You just need to wait for the other side to reply. In addition, if both ends press the button at the same time, neither of the two subscribers can hear the other. Customers have to purchase a new handset, and widespread acceptance of PTT will hinge on roaming and/or interoperability agreements among carriers. The quality of PTT service still needs to be improved.

16.5 RFID

A radio frequency identification tag (RFID) is a bar-code application with encoded intelligent data waiting to be read; it can communicate with a networked system. One such unit is shown in Figure 16.3. RFIDs can be used in many ways, such as tracking items in a supply chain; having an RFID tag embedded in a passport; and serving as a generic access control for entry into a building, an office, an elevator, or a parking area. Basically, an RFID receives energy from the electromagnetic waves a card reader emits. On detecting the presence of a reader, as illustrated in Figure 16.4, the tag sends back this data, which then interprets the data that has been sent back.

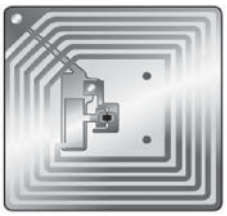

Figure 16.3
RFID Tag.
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Figure 16.4
RFID Scanner.
©iStockphoto.com/ SDbT

RFIDs have been miniaturized, and passive RFIDs are available for as little as 7 to 20 cents and hold great potential in the networking world. RFIDs can be categorized as passive, semi-passive, and active. Passive RFIDs rely entirely on external

energy to become active and receive that from a reader. Passive RFIDs are cheaper and disposable and have a detection range of about 20 feet. Active and semi-passive RFIDs can be detected from up to 100 feet or more as they have their own internal batteries. These are generally used with expensive merchandise. Active RFIDs utilize the battery energy for broadcasting, while a semi-passive RFID utilizes the reader's energy for that purpose.

Another way of using RFIDs is based on a data storage strategy, whether they are read-only; read-write; or write once, read many (WORM). In read-write RFIDs, onboard data can be modified. Potential uses include providing consumers with information about products that have embedded RFID tags. Consumers can use their PDAs or cell phones to read the data contained in the tags; this way, they can determine such things as price or expiration date. RFID technology is currently being used on a large scale by Wal-Mart, Sam's Club, and the U.S. Department of Defense.

The use of RFIDs can lead to a reduction of repetitive motion injuries among employees engaged in such actions as checking in, locating books on a shelf, checking out books at a library, or ringing up groceries at the checkout counter. Smart sponges (surgical sponges that have RFIDs embedded in them) have a life-saving potential. Following an operation, a surgeon can wave a wand to determine whether any sponge has been left behind. In addition, RFIDs can linked to debit-card accounts for making transactions on the fly—for example, at country clubs.

Concerns do exist about the ubiquitous deployment of RFIDs, which people might find to be a violation of their privacy. There is also a need for better encryption algorithms to be employed so that data on the RFIDs cannot be read or modified by an unauthorized device. RFID orientation is another shortcoming that could affect whether the data has been read by the reader. Ghost tags are another issue whereby a non-existing tag is read. In spite of these reservations RFID technology has revolutionized supply chain management by improving inventory efficiency, thereby helping to keep track of items in an inventory list, be it items in a shopping cart or cogs in a warehouse. RFID tags can be implanted to identify animals and can be placed in children's clothing, backpacks, and student IDs. Furthermore, they are a requisite for enhanced automation. RFIDs can be used in diverse environments, as they do not depend on the line of sight. RFIDs are clearly here to stay, and rapid research in this field is the only way to create better devices and ease ongoing concerns about them.

16.6 Cognitive Radio

Advances in chip design have enabled increasing complexity of communication networks and creation of applications in mobile wireless networks. However, constrained bandwidth poses a serious hindrance to architectural design. On the other hand, a multitude of experiments conducted in the television bands exhibit stretches of white spaces (i.e., long durations of unused bandwidth by licensed users) as