RFID identification (RFID) is an emerging compact wireless technology for the identification of objects, and is considered an eminent candidate for the realization of a ubiquitous ad-hoc wireless networks. RFIDs utilize electromagnetic waves for transmitting and receiving information stored in a tag or transponder to/from a reader. This technology has numerous benefits over the conventional methods of identification, including higher read range, faster data transfer, the ability to embed RFID tags in objects, relaxation of line-of-sight requirements, and the ability to read a large number of tags simultaneously. Furthermore, RFID, when combined with other technologies/functions such as sensors, ranging, and polymer elements, opens up a tremendous variety of potential applications that could enable the first truly “ubiquitous cognition and intelligence.” Current RFID applications include: retail supply chains, military supply chains, pharmaceutical tracking and management, access controls, sensing and metering applications, parcel and document tracking, automatic payment solutions, asset tracking, real time location systems, automatic vehicle identification, and livestock or pet tracking.

Although RFID is an emerging technology, the principles and first publications date back to the 1940s, when Harry Stockman described the convergence of radio transmission and radar technology—leading to concepts of RFID as known today. Perhaps the earliest application of RFID was the identification of friendly aircraft in World War II. Nevertheless, it took almost two decades of development to come up with the first commercial products. A variety of applications based on RFID appeared in the 1980s (e.g., access authorization, electronic article surveillance, animal identification). While the original applications were mostly related to logistics or keyless entry, this technology is currently being used in a much wider range of applications and these will undoubtedly grow in the future. Nevertheless, the question arises as to whether the chasm has been crossed from an emerging technology to a mature technology with both important economic and social impact. Here we must answer in the affirmative, as billions of RFID devices have been already sold.

There are still numerous challenges in the RFID domain involving, among others, difficulties in the proximity of metals or biomaterials, range enhancement, a multitude of operating frequency bands, integration of minimal-power integrated circuits (ICs) and sensors on low-cost platforms and security, “rugged” flexible materials, effective switching performance and load modulation, collision alleviation, antenna miniaturization, and reliability. RFID technology requires the combination of several scientific disciplines—from analog-circuit to antenna design, from crypto to polymer electronics, and from wave propagation to sensors. It is the aim of this TRANSACTIONS’ Special Issue to present a broad overview of the state-of-the-art in RFID.

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