Current issues in RFID standardisation

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Introduction

According to professional journals, Internet information services and consultants, RFID (Radio Frequency Identification) seems to be “the new technology hype” which “will revolutionise business performance across supply chains” (Accenture). While low-frequency RFID has been used in some areas in the industrial world for more than a decade (e.g. car makers), the recent decision by Wal-Mart and the U.S. Department of Defence (DoD) to mandate to all its suppliers the adoption of ultra-high frequency RFID as a logistics and inventory management tool by January 2005 (Brewin, 2003) is driving a widespread interest in RFID technology throughout other industry areas and in academia.

The supporters of the technology argue that RFID significantly reduces costs, increases the transparency and hence improve the visibility of the entire supply chain, leading one step further towards the achievement of the truly integrated and virtual supply chain. In contrast, the critics draw the attention on the huge technical challenges such as integration with the existing IT infrastructure and the even more substantial organisational changes required by the adoption of RFID such as the changes in the business processes, let alone the high costs of the RFID tags that hamper the implementation and use of RFID. Another major obstacle for the widespread adoption of RFID are RFID standards. In a global business environment, the lack of interoperability between systems based on RFID technology in different parts of the world deter users to make large investments in a technology that has to be used on a global basis.

This paper seeks to provide an overview of the current situation of RFID standardisation issues, with a particular focus on the different, and often competing, interests of the actors involved in the two standard life cycle stages: standard creation and standard use. After a brief section describing the RFID technology and identifying a number of issues related to the development and use of the technology, the following two sections analyse the two RFID standardisation stages: standard creation and standard use in order to unveil the challenges surrounding the standardisation issue. The conclusions summarise the observed phenomena and identify areas of further research.

Background

Technology

RFID is defined as a method of identifying unique items using radio waves (http://www.rfidjournal.com). RFID technology allows the automatic collection of product, place, time and transaction data quickly and easily without human intervention. An RFID system includes a reader, a transponder, and their associated antennas. The reader transmits the radio signal, through its antenna, that the transponder receives via its own antenna. The transponder converse with the reader to verify and exchange the data. Once the reader receives and eventually verifies the data, it sends it to a computer for processing and management.

RFID readers are automatic locks, fixed or mobile hand held scanners. They are usually connected to a computer and serve the same purpose as a barcode scanner. The transponder, also called tag, smart card or smart label, consists of a chip containing a processor and a receiver, and an antenna to broadcast and receive data via radio frequency. Dependent on the installation size of the antenna and the air interface protocol, the coverage reaches up to several meters. In contrast with the barcode, the transponder can be read without direct visibility and is contact-free. Additionally, transponders can store more information and are safer in terms of staining or abrasion. A huge advantage of RFID is the parallel data collection: a RFID reader can read up to 200 tags. Active and passive tags or transponders are available. The antenna connected to the RFID reader activated the RFID tag and transfers data by emitting wireless pulses.

Issues

The issues surrounding RFID technologies can be categorised in five main categories:

1. The RFID market is congested, with a massive amount of diverse players such as chip makers, transponder manufacturers, system integrators or consultancies, all of whom offer different, and generally proprietary, products and services. Available systems consist of different frequency ranges, transfer modes, etc. For a potential customer, it is difficult to acknowledge the distinct benefits and disadvantages of these different RFID solutions.
2. Currently RFID technologies cannot offer a so-called “killer application” which is an off the shelf standard solution. A selection of different RFID systems has to be done by the users depending on the organisational specific process and technological requirements.
3. Due to the fragmented market (a variety of individual RFID products and services), the total cost of RFID implementation are not transparent. Apart from the fact that transponder prices range from 50 Eurocent to 80 Eurocent, the exact price calculation as part of a cost-benefit analysis is difficult because of the number of unknown variables. A RFID implementation cost analysis has to take into consideration not only the investment in the transponders and readers, but also other cost drivers, such as peripheral systems, software and integration efforts.
4. The discussion in the media regarding RFID implementations often is driven by high promises in terms of expectations, that is cost reduction and improved visibility of the supply chain. If these expectations are not fulfilled at short notice, potential customers tend to lose their interest in RFID.
5. RFID technologies requires a huge effort in terms of standardisation. RFID standards are a major issue in securing the high investments in RFID technology on different levels (e.g. interface protocol, data structure, etc.). Not only different standards co-exist in parallel, but also different actors with sometimes divergent interests influence the standardisation life cycle.

This paper addresses the last of these issues – the challenges surrounding the standardisation of RFID technologies. The standardisation life cycle is conceptualised as formed of two different, yet deeply interrelated stages: standard creation and standard use. The next section discusses the existing approach to RFID standard creation which focuses on the two competing initiatives, the EPC Global approach and the ISO process. EPC Global is more commercially driven by dominant players like retailers, whereas ISO adopts a more global perspective following a generic approach to standards. The implications that RFID standardisation has for the user organisations are discussed in the second part of the paper.

RFID standards creation

There are two competing initiatives in the RFID standardisation arena: ISO and EPC Global. Additionally, there are also a number of special interest groups including industry specific such as the American Trucking Association in the transport industry, the NFC forum in the in consumer electronics, mobile devices and computer industry or the Automotive Industry Action Group in the automotive industry that seek to influence RFID standards development. This section will compare the two major approaches to RFID standardisation, unveiling the underlying conflict that shape the RFID standards creation process, and consequently, the future development of the technology.

The ISO approach

RFID standards first come to scene during the early 1990s, when the (newly created) CEN TC225 committee on bar coding focused the attention on automatic ID techniques in general. During the early 1990s, the standardisation activity on automatic ID techniques was mainly carried out in Europe within the CEN standard body (TC225 committee), with little involvement from the US. However, during the 1995, a joint ISO IEC JTC1 committee – the SC31 – was set up for standardisation of automatic identification techniques generally drawing from the earlier work on RFID standards within CEN. Another influence on the RFID work within ISO was the work on the GTag initiative for RFID standardisation of asset tracking and logistics which was launched by UCC and EAN in 2000 along with input from international companies including Philips Semiconductors, Intermec, and Gemplus.

The members of the SC31 committees are the representatives of the national standard bodies such as in UK the BSI IST34 committee on far coding, including the same people who tend to participate in CEN TC225. They represent either internal consultants within big corporations, or external consultants which are representing the interest of different companies. As a result, three different levels of representativeness (and thus interests) can be identified in the ISO process: the individual, the organisational, and the national level.

RFID ISO standards cover 4 different areas: technology (e.g. ISO 18000 series), data content (e.g. ISO 15418), conformance and performance (e.g. ISO 18046), and application standards (e.g. ISO 10374), and the focus here is on the technology standards, the ISO 18000 series, and in particular the air interface standards, which are developed within the SC31 committee. The ISO standards are defined at a very high level, focusing on the interface rather than on the data which is transported. As a result, ISO standards are generic, being able to be supported by any system and in any context, irrespective of the data that is being carried.

The EPC Global approach

In parallel with the ISO standardisation efforts, MIT and UCC together with a number of industrial partners including Procter & Gamble, Gilette and Wal-Mart set up the Auto-ID consortium in 1999 to research RFID technologies and standards. The members included end users, primarily from consumer packaged goods, large retailers and solution providers, including hardware and software providers and consultants. The Auto-ID members included large retailers such as Wal-Mart, Gilette, Coca Cola, Unilever, Tesco, Carrefour and Ahold (http://archive.epcglobalinc.org/aboutthecenter_oursponsors.asp).

As the membership of Auto-ID became larger and more diverse, and with the increasing need for global ”legitimate” standards, the members recognised the need for the creation of a formal standard body that would take over the standardisation and commercialisation work within Auto-ID. A new entity was created in October 2003, the EPC Global as a joint venture between UCC and EAN. Whereas Auto-ID would continue to research RFID technologies, EPC Global focuses on standardisation activities, as well as their commercialisation.

In contrast with ISO RFID standards which are generic standards, EPC standards are specific. EPC standards describe the tag and the air interface depending on the data being carried. EPC standards prescribe the physical implementation of the tags and readers, rather then specifying their generic characteristics. The standards are also much more limited in their scope, for example where the ISO standards for air interface cover all the frequency range, EPC operates only within the UHF between 860-930MHz with one standard for 13.56MHz (http://www.infomax-usa.com/rfid.htm). The EPC standard activities, although taking advantage of the resources of the parent organisations in terms of expertise as well as potential users, is separate from the generic EAN UCC standardisation process. Such distinction is required due to the difference in the nature of standards and the need for a fast standard development process.

ISO vs. EPC

Whereas ISO can claim that it reflects the global requirements into a legitimate process (equal footing and consensus based), EPC focuses on speed and emphasises the broad support it receives from the industry community. The ISO and EPC processes can be seen as complementary, even more so when one consider that the only competing area is the standard for air interfaces frequencies. However, for both EPC supporters and for ISO the need for a single, global standard is impetuous. The benefits coming from standardization would be lost if in different parts of the globe, multinationals would have to invest in different technologies for RFID.

RFID standards use

Today, RFID is used to track and identify parts/goods moving through shop floors or warehouses in order to get accurate data. Technologically, RFID has the potential to simplify the process of tracking parts, without any line of sight and with multiple tags that can be detected simultaneously. As such, RFID systems are a useful tool in improving the visibility in the supply chain, hence reducing time and costs. One major user of RFID technology is the retailing industry to track inventory and gather information at the point of sale about customers shopping behaviour. Among the early adopters is also the automotive industry which uses RFID technologies during manufacturing processes to track parts in the supply chain. Claimed benefits of RFID standardised technology supposed to improved supply chain efficiency, for example significantly lower transport and operating cost, reduced capital, or the stop of misplaced packaging during transport when moved between suppliers, or to cut off fraud.

The different actors in the RFID standards use are technology vendors, consultants and user companies. Whereas technology vendors proclaim RFID as a huge market opportunity to sell their technology and promise big benefits, the exact distribution of this benefits seems to turn out as big problem. Additionally, a number of problems emerged during our case study that deter use. For example, the standardised RFID technology seems not to be mature enough to satisfy the user requirements, or integration with existing IT system. Additionally, as usually in the case of IS implementation, the challenges associated with internal organisational change required by the change in the business processes due to RFID use create massive problems. Under these conditions, the users care less about standards and more about the practical cost-benefit analysis of the technology.

As Jakobs (2000) found in his study of user involvement in standard committees, the interests of the users are usually translated in the standard creation process through the vendors. Early data from our case study seems to point out that this is largely the case in the EPC process, with only very large users getting actively involved in the process, and even more so in the ISO process where the system of national representativeness constrains participation. As a consequence, users – with the exception of big corporations which look to influence the standardisation arena for market purposes) - are largely not involved in standards creation because not only because the benefits gaining from participation are lower than the participation costs, but also because of a lack of interest.

Conclusion

From the user point of view, the implementation of RFID is in its infancy despite all the promising announcements of RFID technology vendors and consultancies predicting a boost in sales figures for RFID technology and related services. Due to market and in particular significant cost pressures, as well as the regulatory demands, some industries are more advanced than others, in particular retailing and the automotive sector. Although organisations are well aware of the benefits RFID provides, a significant number of questions remain still unanswered. For example one of the issues companies face which are working on a global basis is the support and maintenance of different standards which is expensive and intricate. Further research should particularly focus on investigating the dynamics of RFID standards development and use in a jointly approach.