Title:

Auto-Id technology in retail and its potential application in marketing

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Synopsis

This paper describes the Auto-Id technology and key components. It explores some of the issues associated with its widespread use. Finally it explores the potential business applications in marketing.

Introduction

The Auto-ID Center at Massachusetts Institute of Technology (MIT) announced the launch of version 1.0 of the EPCglobal Network in September 2003. This was a key milestone in the launch of a global set of standards and technologies that allow individual items to be tagged with microchips or RFID tags. These tags carry the Electronic Product Code (EPC), which allows these objects to be uniquely identified and through wireless technology, detailed information maintained on the object.

The products on the shelf can now talk to you and have a distributed memory.

This paper describes the Auto-Id technology and key components. It explores some of the issues associated with its widespread use. Finally it discusses the potential business applications in marketing.

Auto-ID Technology

There are several components that make up Auto-ID technology (1). These include:

- eTag, an electronic tag
- Electronic Product Code, a unique identifier
- Object Name Service (ONS)
- Savant Systems
- Physical Markup Language (PML)
- Business applications

The primary focus of the Auto-ID technology is to embed the Electronic Product Code into product items; this results in objects that are intelligent and can communicate.

The following section described the components in more detail:

The Electronic Product Code

A corner stone of Auto-ID technology is the Electronic Product Code (EPC). It is a string of numbers that provides a unique identification. For instance, instead of referring to a class of products as Universal Product Codes (UPC's) do, the EPC refers to a specific instance of a product .

eTag

To facilitate Auto-ID, the EPC is embedded in a memory chip contained within a smart tag (eTag) on individual products. The chip in turn is connected to an antenna. This allows for the eTag to be scanned by a radio frequency reader, which transmits the embedded identity code of the product to a network, where the detailed information on the product is kept. This detailed information can then be communicated back from the network to provide whatever information is necessary about that product.

Radio Frequency Identification (RFID) is the basis for current Auto-ID technology. It is important to note that the baseline functionality of these eTags provides read-only access to the EPC. No detailed information need be kept on the eTag.

The current technology and standards do not preclude other tags with read-write functionality or even more advanced capabilities. However, as additional functions and capabilities increased, so will eTag costs. Currently read-write tags tend to be slower and have a shorter range than their read-only counterparts.

Implementation of EPC does not depend on RFID technology; any way of being able to quickly and easily read a unique id from a product will work. RFID is the most common option at the moment but other technologies are being tested.

The Object Name Service

The next step in the Auto-ID chain is the Object Name Service (ONS). The ONS tells computer systems where to find information about any object that carries an EPC. ONS is based in part on the Internet 's existing Domain Name System (DNS), which routes information to appropriate network interfaces. The ONS will likely be many times larger than the DNS, serving as a lightning fast post office that locates data for trillions of objects that will eventually carry an EPC.

Savant systems

Savant is a software technology that acts as the central nervous system of the EPCglobal Network. Savant manages and moves information in a way that does not overload existing corporate and public networks.

The Physical Mark-up Language

Physical Markup Language (PML) is a new standard language for describing physical objects, in the same way that Hypertext Markup Language (HTML) is the common

language on which most Internet web pages are based. Almost anything can be contained within the PML description of an object: its physical characteristics such as weight or caloric content, repair instructions and audit trails. PML will allow for manufacturers and retailers to specify and customize the information tracked on products. (It is technically possible for the consumer to start to collect information on the objects that they own) There will not be a vast repository of PML descriptions. Ultimate implementation of the PML descriptions will result in highly distributed data. Manufacturers, retailers and consumers will all have unique views to data.

Business applications

Potential Auto-ID business applications are numerous. They include:

- Manufacturing process control
- Inventory management
- Supply chain optimization
- Regulatory compliance
- Recall management and recycling

In all these areas, Auto-ID offers the potential for significant savings, as well as new sources of incremental revenue. New services will start to emerge as objects start to become smart and interactive. As the technology becomes pervasive, benefits will extend throughout the entire value chain and for the consumer.

Auto-ID technology has the capability to redefine the global marketplace by embedding intelligence, identity and Internet connectivity into everyday objects. The EPC unites elements of the entire supply chain, making it an interactive, dynamic cycle from raw material and distribution to point-of-purchase and recycling, and back to raw material. Products equipped with smart tags will interact with manufacturers, their trading partners and each other to form an optimally efficient cycle of direct, real-time supply and demand.

Applications in marketing

The primary focus of Auto-ID applications has been on supply chain where highest perceived benefits are believed to come. But Auto-Id and similar technologies have a number of unique features that could provide value for marketing. These include the ability to:

- Uniquely identify an object
- Integrate data from wide range of sources
- Read the EPC wirelessly
- Communication during the product purchase decision
- Access the consumer post retail transaction

These features allow the marketer to explore a number of new activities. Many of these activities can be group under the concept of a “Personal shopping assistant”. Examples of these applications include:

While in the store:

Select an item view product attributes

- Where it was made?

- How long it has been in the store
- When its expiry date is?
- What the calorific value is?
- What it contains

Select an item and receive an alert

- Remotely look up the contents of the home larder and confirm if the item is required, alerting the customer where appropriate
- Alert customer to products that they may be allergic to e.g. contains peanuts
- Alert customer that they have a discount voucher for an item

Select an item and view usage information

- View a recipe for an item
- View product survey information
- View product instructions
- View comparison prices at other stores

Prompt customer with location of item

- With pre-defined shopping lists can warn customer when in proximity of required item
- From a selected recipe can warn customer when in proximity of required item

Select item and receive a promotional offer

- Provide the customer with promotional offer at the purchase decision point based on current contents of basket
- Provide the customer with promotional offer at the purchase decision point based on previous purchase behaviour

While in the home:

Automated shopping lists

- Use information about items in household and consumption patterns to automatically create a shopping list for a particular store
- Use information about pricing to optimize shopping based on price comparison

Select an item and receive an alert

- Warn if an items has gone past its expiry date
- Alert customer to product that a member of the household may be allergic too e.g. contains peanuts

This is just a short list of potential marketing applications; the key is that this technology will allow us to integrate data form a wide range of sources wirelessly.

Issue with Auto-ID

As with any revolutionary technology, there will be challenges to overcome in Auto-ID implementation. Some challenges are technological in nature, some economic, and some societal. The following are some of the issues:

- Privacy
- Accuracy
- Interference
- Performance
- Frequency Availability
- Security
- Data ownership

These are discussed in more detail below:

Privacy

Perhaps the most controversial issue is that of privacy. The ability to track an item after it has been purchased raises a number concerns for consumers. Although there are limits to the current technology the following may be possible in the future.

E.g. Item of clothing stolen from store, this then gets sold on to an individual who visits a location with a radio receiver. The systems could then “check” to see if it was paid for.

As consumers see value in the technology, and these genuine privacy concerns are addressed by the industry, acceptance is likely to increase.

There are also some legitimate competitive issues. For instance, since the EPC’s will be global and unique, it may be possible to determine specific product information from the EPC given enough data. Imagine knowledge of your competitors ’shelf assortment and inventory levels gained through a store walkthrough, accompanied with a hand-held reader.

Accuracy

Readers cannot be guaranteed to be able to communicate with all tags in a volume 100% of the time. Environmental issues, the make-up of the products being tagged and the volumes of tags to be read all impact on read accuracies. The degree of concern is proportional to how much an enterprise relies on absolute data. RFID offers many advantages over manual or semi-automated data collection processes. Any shortcomings in accuracy can be mitigated through the use of redundant readers, information auditing and process redesign.

Interference

As readers proliferate, more occurrences of interference will be seen. Depending on the frequencies and powers used, devices such as mobile phones, wireless handsets and industrial equipment may be affected. Since such a widespread penetration of RF technology has not been undertaken before, it is difficult to state explicitly what will be impacted.

The perceived health risks of this much radio frequencies may also come into play. While there is no evidence that there are any negative effects at the power and frequency levels associated with RFID, no one has rolled out such large-scale implementations yet.
More research and monitoring will need to be conducted to address the public’s concerns in this matter.

Performance

Smart objects could generate tremendous amounts of data. This much data will not be accessible if stored in a massive central repository, so some distributed data will be necessary. This raises a number of performance issues.

Auto-Id is based on RFID technology. Anyone who has used a mobile phone knows the issues associated with access to network.

To work the data associated with EPC's will need to be available on demand anywhere.

Frequency Availability

Since RFID currently uses unlicensed RF spectrum, the available spectra that is usable for RFID is an issue. Although there are some frequencies that are common, there is no universal standard.13.56 MHz and 2.45 GHz are both worldwide standard Industrial, Scientific and Medical (ISM) frequencies. These are available in most parts of the world, albeit at slightly different restrictions.

However, more useful in terms of read range and speeds are tags operating at roughly 915 MHz or ultra-high frequency (UHF). The UHF spectrum around 900 MHz is not universally available at the same frequency and power levels worldwide.

This will be addressed through two potential methods. The first alternative is multi-frequency readers. Overall RF system design (integration of antenna, readers and tags) is the most difficult part of the problem. The second is to select a common frequency. Obviously, since this involves millions of stakeholders, the lead-time on this will be considerable. This does not, however, deal with the fact that not all frequencies work well for every application (although some work well across virtually all applications).

Security

Security will be paramount, and my be viewed a a number of levels. There is

- Read security (or being able to read the tag)
- Security of the data
- Other security issues.

For users of the technology to feel comfortable, there will need to be assurances that no one will be able to "hack "into a smart object. As long as tags are read-only and are difficult to counterfeit, then security will be high. Users of Auto-ID technology will also need to rely on the security of Auto-ID data on the network.

Data Ownership

Related to security, data ownership is an issue. Who owns the massive amounts of event information associated with an object?

It is clear that the manufacturer owns the design specs and other PML type data for a given product. It is clear who owns captured data -the owner of the reader that read the tag. It is less clear, however, how information will be shared.

Many parties will be privy to and will update the data for an object as it passes though a supply chain. Will those collecting the data ever want to share data. Does an end-user (consumer) ultimately own a product and its data, and if so, how does use of that data for process improvement or data mining impact privacy?

Lastly, although killing a tag when purchased has been discussed as an option, this method eliminates future recycling benefits, and also introduces the potential of tags being killed maliciously or by accident, before they should be.

Conclusions

The ability to uniquely identify an item through the use of an Electronic Product Code (EPC) is a natural extension to the Universal Product Code (UPC). Allowing this EPC to be wirelessly read and integrated with detail data across a global network is a major leap in functionality, which will provide manufactures, retails and consumers with significant benefits.

The development of Auto-ID technology is evolving, but its widespread use is unlikely for many years. The early adopters are likely to be industries where the value of a unit is high and tracking individual items is important. Prime targets include pharmaceuticals and the automotive sectors.

To date the focus has been on improving supply chain management. Little attempt has been made to explore the potential marketing applications of this technology. I believe that it has a number of unique features that will prove valuable to marketers when developing point of sale communications. It also offers the opportunity to extend the marketing communication process into the home environment and the full product lifecycle.

Acknowledgements

Auto-ID Center Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building 3-449, Cambridge, MA, USA.

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