RFID 501: RFID Standards for Libraries

This is an exciting time in the evolution of RFID (radio frequency identification) technology for libraries. National and international committees will soon finalise a number of important standards that have been under development for several years. These new standards will improve the interoperability and flexibility of library RFID systems and make the technology even more valuable.

- **Interoperability.** Shared standards will allow one manufacturer's tags to be recognised and read by equipment from another manufacturer. This capability is increasingly important as library networks become more integrated—as more books and CDs from one library system are loaned to other systems. Interoperability also increases the potential for tagging by publishers and distributors.
- **Flexibility.** The new standards will also give libraries greater flexibility in designing their systems and purchasing their equipment and tags. With standards, they can make purchasing decisions based on features and performance without worrying about compatibility with equipment that has already been installed in the library.

Following supplement info should be added for understanding:

Standards provide libraries an independency
- on system or RFID Tag suppliers
- a standardized interface to different library systems
- and backwards compatibility to the existing barcode system.

Standards also give libraries a measure of confidence in their investments. Although standards certainly can change, libraries can be assured that such changes will be accepted throughout the industry and that a system purchased today won't be quickly outdated.

Hardware versus Application Standards

Two kinds of standards affect RFID. Hardware or technology standards address equipment issues; software or application standards address the arrangement and handling of the data that is handled by the equipment.

Several years ago, the International Standards Organisation (ISO) began to establish RFID technology standards that affect RFID applications in different settings—such as security access, payment systems, retail stores and libraries.

These technology standards address the communication between the tags nd the readers; they do not address RFID tag or equipment quality or reliability.

One of these ISO RFID technology standards—known as ISO 15693—addressed contactless integrated circuit devices, which are sometimes called proximity cards. These are used for security access or payment systems. These applications are typically designed to identify people, but some manufacturers saw that the same standards could be applied to the identification of items. Some early item identification applications were based on ISO 15693.

Eventually, ISO developed a new series of standards—the ISO 18000 family—that addresses how tags and readers communicate in a number of item identification applications. One of these, ISO 18000 Part 3, identifies 13.56 MHz as the frequency for tag-reader communication in these applications. ISO 18000 Part 3 Mode 1 is the type of tag commonly used in many of these applications, including libraries.

These hardware standards are obviously necessary, but they are not sufficient to allow interoperability among libraries. Setting the communications frequency ensures that the reader and tag are on the same wavelength. This is similar to presetting a car radio to a favourite station. It does not address the "language" of what's being broadcast, though. For RFID systems to work together, the language also needs to be standardised.

Storing Data on an RFID Tag

To understand the value of a common language, consider how data is stored on an RFID tag. Before that can be encoded onto the RFID tag. Usually each library item is identified by a primary item identifier that can be, but need not to be , equivalent to the (former) barcode. Before that data can be encoded onto the RFID tag, it must be converted into the zeros and ones that make up the language of computers and RFID tags. It is then programmed onto the tag.

The data can be converted to binary data elements (ones and zeros) on the tag in several ways. Additionally, there are many locations on the tag where the data may be placed.

Consequently, only someone who knows and employs the approach used in the original coding and location can decode the tag.

Without a standardised approach to coding, a library often cannot decode an RFID tag and correctly identify an item it receives from another library. Obviously, this impacts interoperability and customer satisfaction based mainly on the encoding method originally used on the tags, or face a significant expense to reprogram the tags in the collection. These are among the reasons why many libraries have been closely monitoring the evolution of application standards.

Applications Standards: A Status Report

The library RFID industry started with a diverse set of proprietary models for handling data, each determined by the individual manufacturers.

Eventually, four countries adopted national models. The Dutch standard was developed in 2003 by a consortium organised by a large book producer who was selling into the library industry. The Danish technical report on a data model was next, in 2005. The following year, a Finnish standard with few additions, was adapted from the Danish model, and an independent standard was developed by the French.

Considering the different national data models and the intention to replace e.g. barcodes with RFID systems, the International Standardization Organization (ISO) adopted the work on international standards for item identification in libraries.

In general, all data models divide data in mandatory, optional structured and optional unstructured elements. How many elements are allocated to mandatory or optional depends on the used data model itself and on the specific needs of library.

Fixed and Object-Based Encoding

Each of the four European models uses a "fixed encoding" approach, in which the placement of data on the tag is prescribed and a definite number of bytes is allocated for each piece of data. When ISO started the work in 2006, it analysed that the fixed encoding models lacked the flexibility that would be desired in other countries e.g. in the US, UK, Australia etc.. Flexibility in the context of individual library need on required data elements and data capacity. The alternative to the European models was an object oriented encoding approach, adjusted to the library needs, derived from the already existing standard ISO 15962.2004 that is using an object identifier structure to identify the data elements on a tag.

This object-based approach was based on ISO 15962, an existing standard that specifies how data objects—which are essentially pieces of data—should be encoded in regards to data compaction and formatting, on RFID tags.

With object-based encoding, the tag is programmed with data objects, which could include the item identification, the media format, the home library, the interlibrary loan borrowing institution, a transaction number or something else. The encoding of each data object tells the reader how that object is compacted on the tag and the size of the data. And then it gives the actual data.

Object-based encoding, as defined by the ISO 15962 standard, has proven its flexibility and efficiency through years of use in several industries in regards to data compaction and formatting.

- **Flexibility.** With object-based encoding, ISO can add new data elements (for example, a book's weight) when the industry deems it necessary. This approach allows each nation—and each library—to decide the size of the tag and which of the ISO-approved data elements it wants to use for its unique requirements.
- **Efficiency.** Object-based encoding treats numeric data in a manner that's efficient for numeric data. If the information is in an alphanumeric format, it is encoded in a manner efficient for alphanumeric data. This efficiency saves tag space, which is important because it impacts tag size and the time needed to read the data.

Because the data set is smaller with object-based encoding, the system can use smaller tags. And because the system only needs to read the portion of the tag containing data, it spends less time reading the tags, which means better performance in the library.

The efficiency of object-based encoding varies somewhat, depending on the data set allocated by the library.

The Application Family Identifier

Another feature an Application Family Identifier, or AFI, code.

Note:fixed data models can have also the AFI like e.g the Danish or Finish model.

Also 15961 + ISO 18000-3 mode 1 includes info about AFI

The AFI code serves several purposes. It was originally developed to distinguish applications, so that a tag will respond to a reader only if the AFI codes match. This eliminates interference between applications. For example, it ensures that an airport baggage-handling RFID system reads and responds only to baggage-handling RFID tags and not to the tag in a library book packed within a suitcase.

In addition, several RFID vendors use the AFI as a security mechanism. There are two AFI codes, one for items that are checked in and another for items that are checked out. When a patron takes an item through the library's security gates, the system asks the tag to respond if it has not been checked out. If it responds, the alarm will sound. The AFI is not part of user data elements that are allocated for library application, it is part of the systems memory of the tag.

ISO Standards: a Status Report

As noted earlier, the ISO has formed an international working group to develop applications standards that will allow global interoperability. At this time ISO developed three different working drafts standards of standards, called ISO/WD 28560 part x.

- **Part 1** describes in general the data elements that can be used for libraries.
- **Part 2** describes the object based encoding drawn from ISO 15962. The only mandatory data element is the Primary Item Identifier (Barcode). If more optional elements are needed like e.g. owner of library, item set information, shelf location etc. an object index is required that the library system knows the particular elements that can be accessed on the tag. The advantage is the flexible memory size of tag due to the data elements that are stored.
- **Part 3** describes the fixed length encoding similar as already used e.g.in Denmark. Five data elements are mandatory (the Danish model includes 8 mandatory elements)

Recently, drafts of the three ISO standards (one for data, two for encoding) were completed and circulated. Final standards should be published by the end of 2008.

Even though final publication is some months away, many library systems are moving forward with plans to implement RFID systems. Any variations from the draft standards are expected to be minor and established vendors will have little or no problem adapting the planned systems to accommodate any changes.

What Should You Expect From Your RFID Vendor?

What should libraries expect from an RFID vendor? First, your vendor should monitor and, ideally, participate in the standard-setting activities previously described. This indicates a commitment to the industry and the library market.

Second, your vendor's product should reflect the latest developments in standards.

Third, your vendor should be willing to support your migration to utilise changes in those standards when they are available. That commitment to support a migration should be explicit. To ensure that you can migrate, it is critical that the data on your tags is not locked. Data on an unlocked tag can often be reprogrammed to conform to a revised standard. Locked data is permanent and cannot be altered.

Appendix 1

Additional Information on Tag Standards Evolution

The following Web links provide additional information about the evolution of tag standards in several markets around the world.

- NISO RFID Best Practices Model
  www.niso.org
- ISO Working Group
  www.bs.dk/standards/rfid
- Application Family Identifier (AFI) assignment for Library Industry
  www.bs.dk/standards/RFID/AFI_Preliminary.pdf
- Dutch RFID Data Model
  www.debibliotheken.nl/content.jsp?objectid=5179
- Danish RFID Data Model
  www.bs.dk/standards/RFID/RFID_Data_Model_for_Libraries_April_2006.pdf
- Australian Best Practices Document
  www.sybis.com.au/Sybis/4n597-599%20proposal%20document.pdf
- Finnish RFID Data Model
  www.lib.helsinki.fi/katve/toiminta/docs/RFIDDataModel-FI-20051124.pdf
- French RFID Data Model
  www.addnb.fr/IMG/pdf/normefrancaiseRFID.pdf
- International Airline Transportation Association (IATA) use of RFID
  www.iata.org/pressroom/briefings/2005-11-18-01
- Food Animal ID use of RFID
  www.idtechex.com/products/en/articles/00000379.asp
- Health Industry Barcode Consortium (HIBCC) use of RFID
  www.hibcc.org/PUBS/WhitePapers/RFID%20Guideline.pdf

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