

Guidelines for the use of RFID in libraries

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Introduction

Since Book Industry Communication (BIC) produced their guide in January 2008 there have been some significant changes in the world of library RFID. New standards, new hardware and increased co-operation between suppliers and their clients have radically changed the technological landscape. This guide seeks to inform and advise those who are planning to invest in RFID for the first time as well as offer guidance to earlier adopters considering the implications of change.

Executive Summary

This guidance document provides an overview of RFID (**R**adio **F**requency **I**Dentification) implementation for libraries. Key points showing how investing in RFID can provide long term benefits for the library service, and an improved customer experience are highlighted below.

Benefits

- Self-service - cited as the single most important reason for deploying the technology.
 - Self-service enables longer hours of accessibility to customers to borrow books, and if the right equipment is available, cds, dvds and other items for loan. It can also reduce queuing time for customers.
 - Self service is of particular use if the library service is co-located with other services (for example, Dudley Library Access Points, Downham Centre in Lewisham and the 24 hour vending machine at Newcastle City Library, which provides a range of books and DVDs from an external 24 hours service) enabling book loans to take place out of regular library opening hours.
- Staff benefits – staff in a library with RFID are released from back office duties, enabling them to have a more customer-focused role. Libraries which have implemented RFID and combined it with a staff training programme have had the most success (for example, Westminster, Norwich Millennium Library and Newcastle City Library).¹
- Automated sorting – peak return volumes can be analysed and books returned to stock automatically
- Increased security – books and other items for loan can be security tagged, triggering an alarm if removed from the library without being issued.
- Stock Management – inventory, finding lost and missing items, identifying misfiled stock or identifying particular items for display or relocation can all be carried out using a scanning device.

¹ See *MLA case studies* at http://www.mla.gov.uk/what/raising_standards/best_practice

- Floating stock – books may be borrowed from one library and returned to another, improving the level of service for increasingly time-poor customers.
- Smart Shelving – book circulation levels can be monitored and shelves arranged according to customer preferences.
- Interactive Displays – it is possible to link stock availability to display screens, for ease of customer information.

Cost

- The costs of implementing RFID vary – depending upon the level of service selected. It would, however, be a wasted opportunity to opt for RFID for only stock issue and return
- In Cornwall for example, the introduction of RFID across libraries was funded through a £1.25 million *Invest to Save* grant from the council. More than £150,000 is being saved each year by the introduction of the technology².
- In Westminster, £584,000 in total was spent introducing RFID to its Paddington, Marylebone, Victoria, Charing Cross and St John's Wood libraries. However the service is on course to recoup these costs within the next four years as well as make regular annual savings of £200,000.³
- Westminster's business case was predicated on revenue savings of £200k which gave a 3 year return on investment for the capital outlay, of approximately £600k. This was modelled on a 65% take up of self service by the public, but as the actual take up is nearer 90%. In addition, some additional capacity for staff to do floor-walking and outreach has been introduced. The roll out to all other libraries by end of this year has no net saving directly attributable to this but will enable libraries to cope with the volume increase in business which has been experienced - more visits, book loans etc - without the need for additional staff, or compromising the customer experience.⁴
- The standardisation of RFID operations across libraries in the UK, if adopted by library services, would lead to enhanced interoperability between library authorities and potential efficiency savings.

Sustainability

- The agreement to comply with ISO 28560-2 in 2010 and the introduction of a UK standard for RFID ensures that essential elements of the data will become standardised across suppliers, improving interoperability in the future.
- The potential for using more data will change the way library functionality is delivered. Some RFID suppliers have anticipated this potential by developing

² <http://www.publictechnology.net/content/14827>

³ http://www.mla.gov.uk/what/raising_standards/best_practice/Westminster%20library

⁴ Information supplied by Westminster Libraries

their own (proprietary) means of utilising tag intelligence. By doing so they are creating solutions (and stock) that will only function with their RFID equipment. Moving to ISO 28560-2 will help overcome this problem.

Interoperability

- All the major UK RFID providers have agreed to follow the example of many of their European counterparts and adopt a national data model for library RFID use. In effect this means the creation of a level playing field allowing both greater interoperability and competition between suppliers.
- The introduction of a new data model and standard for RFID in libraries (ISO 28560-2) means that the entire industry now has a standard for the encoding of tags
- A single data model allows libraries to pick the best combination of solutions rather than being tied to a single supplier. Libraries using the same data model can share resources more effectively – allowing for more cooperation between public libraries and easier inter-library loan management for all.
- Increased competition and greater innovation may make choices of supplier slightly more demanding than at present but will also allow libraries to become even more creative in building RFID solutions.
- With a common data model enabling every RFID equipped library to read and identify stock from any other, it will be easier to overcome one of the major obstacles to inter-library authority cooperation.

1. Brief history of RFID use

RFID (Radio Frequency IDentification) technology has been in existence in various forms since 1948 but it has taken almost sixty years to arrive on the library scene.

As the name suggests RFID uses radio signals to send and receive data to integrated circuits (chips) attached to, or inserted into, everything from elephants to emeralds.

Chips are usually attached to a 'form factor' – often a sticky label of some kind – to enable them to be carried by the objects being monitored. These “tags” come in a bewildering variety of shapes and sizes, operate at a wide range of frequencies, and may be active (powered) or passive.

For some time now, many libraries have been tagging their stock in this way. However, in different parts of the world RFID companies have chosen different ways to deploy the technology. Libraries with existing IT solutions – like a Library Management System (LMS) – have “bolted on” RFID solutions to improve key elements of the service - like self service. Others have used RFID to introduce automation to their libraries for the first time.

Library RFID suppliers programme their tags differently, and in some cases may even use a different frequency.

These are issues that are usually of little concern to the mainstream RFID market. Whilst the radio transmission aspects of the technology are necessarily well regulated the actual data being transmitted is more often deliberately encrypted or otherwise protected. Applications also change frequently to meet changing circumstances.

Libraries however have a couple of characteristics that are not shared by the commercial world.

First of these is longevity. Whereas the library supply chain resembles that of other industries in many ways the length of time that items remain active is significantly longer. That means that stock labelled today should still be capable of being read in many years from now. That implies that any changes in the design of RFID solutions must be backward compatible – and that includes the tags themselves.

The second major difference between libraries and commerce is the former's predilection for sharing. Whether that is between different branches of the same

organisation or between different library services (like public library consortia) the need for some kind of conformity is vital to success.

In a few countries, such as Denmark, these differences were recognised at the outset and RFID was introduced with the active participation of the library community, through the Danish Library Agency. Most notably they recognised that if they were to build a public library service that would enable borrowers to borrow and return items from any service point, they would require RFID companies to agree to use the same “data model”, frequency and tag design for each library. That had the added benefit of allowing libraries to choose freely between suppliers when selecting equipment.

The UK, along with many other countries, most notably the US, left the market to take whatever direction it chose. Only in 2009 - following the development of an international standard (ISO 28560-2) - did UK RFID suppliers finally agree to adopt a common data standard – although this is yet to be implemented in a UK library.

At the present time almost 100% of all UK libraries using RFID have purchased a solution from a single supplier. Changing that supplier is a daunting prospect as existing tags or software will almost certainly have to be re-programmed, and resource-sharing, using RFID, with libraries not using the same supplier is impossible.

This document seeks to explain why all that is changing, what the new standard delivers, and how it will eventually change both the means of procurement and the range of services that may be delivered.

2. Benefits of RFID

Early adopters of RFID cite self-service loans as the single most important reason for deploying the technology⁵ at the outset but an increasing and sometimes bewildering array of solutions and the devices that support them are now available. This section examines the main areas of library operation that are impacted by RFID – so far – whilst sections 3 and 4 look at the different types of hardware, and the software used to operate them, in more detail.

2.1 Self Service

⁵ RFID surveys 2009, 2010 by the author. Results published in CILIP Gazette and on the author's blog at: http://www.mickfortune.com/Wordpress/?page_id=201

Anecdotal reporting of circulation figures from a growing number of RFID-enabled libraries suggests that some are now achieving between 70-90% of their transactions being processed via self-service although there appears not to be any published data to support such claims.

Levels of use appear to be more heavily influenced by the library's **commitment** to self-service rather than by the actual devices used. Careful consideration to library design and the prominence and accessibility of self-service units seem to deliver the best results.

Automated returns sorters can identify items by collection, status or other LMS-defined categories, communicated by SIP⁶, and deliver them to a trolley, bin or shelf location as required, simplifying tasks for staff and increasing the accuracy of both stock filing and reservation management.

In addition, self-service may be deployed to provide out of hours service, or to facilitate lending at unstaffed locations particularly in shared services.

2.2 Stock Management

One of the major advantages of using RFID tags rather than barcodes is the removal of the need to handle the item. Operations such as taking inventory, finding lost and missing items, identifying misfiled stock or identifying particular items for display or relocation can all be carried out using a scanning device.

Stock taking with a barcode based service requires every item to be removed, scanned and returned to the shelf. RFID allows staff to simply walk through the shelves collecting data on a hand held device via a radio link. The data collected may then be analysed in a variety of ways. At least one new service provider⁷ is incorporating RFID in the delivery of an enhanced "evidence-based" stock management service.

Another aspect of stock management involves the use of "smart" or intelligent shelving. By constantly monitoring items on the shelf this application also delivers

⁶ SIP – or the **S**tandard **I**nterface **P**rotocol, now in version 2.0, was originally developed by the 3M corporation to allow communication between self-service devices and a Library Management System. A copy of the protocol may be freely downloaded from the company's website at: http://solutions.3m.com/wps/portal/3M/en_EU/Library_Systems/Library_System/Resources/Library_Protocols/

⁷ The product tracks stock use in the library (i.e. unissued) by scanning items removed from the shelves. This, together with data collected from the LMS, allows them to produce "evidence based" reports detailing actual stock usage.

the twin benefits of guiding users to stock and monitoring item use within the library (i.e. determining which items are consulted but not borrowed).

It has also been suggested that the data reported from the shelves is the most accurate record of current stock-holding. It is in this respect that the relationship between the LMS and the RFID system may change. Early reports appeared to indicate that linking live data to the LMS catalogue is not practically possible given currently available communication protocols. To overcome this limitation at least one supplier is actively considering building a new “interface” to the items on the shelf – effectively creating a catalogue based on the physical objects present rather than what are effectively only the latest “snapshot”.

How –and if - RFID deploys smart shelving may prove to be a key indicator in how this technology develops in libraries. If the catalogue can be successfully migrated to RFID the need for a circulation link to the LMS may become redundant. Those considering investing in what is a fairly expensive RFID application may wish to consider carefully not only the practical benefits that might accrue but also what might be the implications for their other automation investments.

2.3 Staff redeployment

With so much activity being transferred to library users the burden of much of the routine circulation work formerly carried out by staff can be removed.

The new stock management functionality delivered by RFID will require staff to learn new skills to exploit the technology effectively. With more accurate information on the use and location of items staff can focus their attention on bringing more creativity to the display and exploitation of their resources.

This may take many forms. Some authorities have redeployed circulation desk staff as “reader advisors” – always on hand to offer help, advice and suggestions for further reading to library users.

Others use this new and highly skilled resource to offer a wider range of information services to their users, often in conjunction with other service providers within the enterprise.

Developing the role of the library as the learning “hub” of its community will require considerable input from its staff; RFID enables them to provide it.

As more and more “mundane” operations are automated the opportunities created for developing a more client-oriented service increase in proportion - although staff will still be needed to cope when these normally reliable systems go wrong.

2.4 Catalyst for change

As the technology develops, and existing issues of interoperability are overcome, RFID will begin to transform the way in which library services are delivered. In particular RFID, in combination with other technologies offers opportunities to take the library service out into the community, for example:

RFID enabled book dispensers are now in use in some UK libraries. Library users use their membership cards to identify themselves to a unit that can dispense the book of their choice and report the loan transaction to their LMS. The concept of the “24 hour library” is already a reality for the readers of Newcastle-upon-Tyne.

With a common data model enabling every RFID equipped library to read and identify stock from any other at least one of the major obstacles to building a national public library service will be overcome. Of course existing users would be required to migrate to the new standard for this to become a practical possibility but once completed the UK could have a library service that operates along the same lines as that offered in Denmark.

But innovation does not end there. With the publication of ISO 28560-2 and the UK data model the potential now exists to store much more sophisticated information on the items themselves and more innovative RFID companies are beginning to think about how services might be improved by doing so.

Two areas of activity that have already been earmarked for improvement are enhanced offline circulation facilities – preventing the accidental loan of material to under-age borrowers during LMS downtime for example – and more effective consortia management.

The building blocks of a circulation system that can operate 24/7 without the need for LMS intervention is already defined within both the standard and the data model. If (or more likely when) this happens investors in RFID will need to consider how much LMS functionality they still require.

3 The hardware

3.1 Tags

RFID tags used in libraries comprise a chip and an antenna attached to a “form factor” (usually a sticky label of some kind). These come in a variety of shapes and sizes appropriate to the labelling of books, DVDs and CDs etc. Labels suitable for other AV materials are available but are often quite expensive as libraries are now practically the only users of audio or video tape.

RFID tags can be applied to library resources to enable both stock management and security.

RFID devices (staff workstations, self-service units, security gates, stock management devices, smart shelves, etc) use antennae to interrogate the tags by radio. Devices may simply read the tag to identify the item, or it may add or change data – dependant on the operation being performed.

In the retail supply chain RFID tags are attached to commercial products which are delivered, stocked, purchased and consumed. This type of product has a very short lifespan and its tag only needs to operate while it is in the supply chain and only up to the point at which it is sold to the end customer.

A library book, however, which may be issued many times and may live on a shelf for several years, needs to have a tag which will be reliable over a much longer span and suppliers need to be aware of how the tag is going to be used and over what period.

Apart from the issues affecting longevity there is another significant element that needs to be considered. The “chip” will normally have a projected life expectancy – usually measured in “cycles” this will indicate how many read/write operations can be expected to be completed successfully before failure. Libraries should ask suppliers about chip life expectancy to ensure that their solution provides adequate re-write cycles and durability.

3.2 Self Service Kiosks

By far the most popular use of RFID to date has been for providing self-service facilities, enabling library users to borrow their own items and process multiple loans simultaneously.

Self service kiosks come in a variety of sizes, from desktop models to “built-in” units and everything in between.

3.3 Automated Returns

Automated sorters also come in a variety of sizes and complexity. Using a system of turntables, lifts and conveyors some European systems now deliver returned books to more than 50 different locations over several floors.

Bins or trolleys are more usually the destination for items that are returned – still one by one – by library users, often during closed hours via an exterior wall mounted unit.

3.4 Stock Management

“Stock management” devices have many uses including taking inventory, finding missing or misplaced items, processing batches of items for relocation or resetting security data on returned items. This is an area of library operation that is attracting the interest of new application providers in addition to extending the functionality of existing LMS solutions.

3.5 Dispensers

Book (and CD/DVD) dispensers are a relatively new innovation for libraries. The best known example in the UK is at the public library in Newcastle-upon-Tyne where a dispenser is used to deliver a “round the clock” lending service.

In other parts of the world public libraries are using dispensers to deliver library services in locations from council offices (in Verona, Italy) to railway stations (in Singapore).

3.6 Interactive displays

“Intelligent displays” (or interactive displays) link content from a variety of sources to physical items held by the library.

Two current models use databases to link content – either stored locally or delivered “live” over the internet – to the item selected by the borrower. There are two main ways in which items identify themselves to the database. Either the entire display is “live”, and items are identified by being removed from the display, or they may be physically transported to a reading station for reading.

At least one university has deployed the “live” display technique to link books to additional research resources delivered via the internet whilst some public libraries are exploring the reading station approach for their children’s libraries.

4 The Software

4.1 Self-Issue, Return and Renewal

Typically devices can be configured to allow a minimum service of loans and/or returns to be processed with some devices allowing for a wider range of activities to be supported – from fines payment to renewal and reservation management. In planning for the introduction of self-service facilities careful thought needs to be given, among other aspects of the service, to overall traffic flows, security (especially where cash is involved) and peak demand for particular functions. Many devices can be configured “on the fly” to meet changing patterns of use.

Operation is straightforward, typically:

- Borrowers present their identification to the unit. (This might be another RFID enabled card, a barcode card, fingerprint recognition or some other technology)
- Depending on library policy they may be required to enter a PIN code or password.
- Items are placed on the reading area
- Items are read and passed for checking to the LMS (using SIP)
- The LMS returns its decision to the Self Service Unit (SSU) (again via SIP)
- Any items that may not be loaned will be advised on screen
- Security data is written to the tags to allow or deny them exit through security gates.
- A receipt may optionally be printed

Instructions and help are usually displayed on a touch screen which may be configured to suit individual library - or even site specific - requirements (supplier offerings vary). Some systems will allow you to print advertisements or other messages on the receipt.

Librarians should remember that complex decisions may be involved in issuing items. For example, is the book eligible for loan, is the customer “blocked”, or the right age to borrow the item? The LMS usually uses complex and sophisticated rules to answer all of these questions - a good reason to consider the relationship between RFID and LMS very carefully.

Following the successful issue of an item the next logical step is:

Return

Items may be returned in a similar way to self-issue but in most cases a borrower card is not required. The operation is even simpler than issue:

- Borrowers place items on the reading table
- Items are checked by the exchange of SIP messages with the LMS
- Borrowers place returned items in bins or on shelves as instructed by the unit
- A receipt may optionally be printed

The system indicates that the item's tag has been read and recognised. This can be signalled in a variety of ways including beep, flashing light or displayed message.

Another function that SIP and self-service may be required to provide is fine and charge payment. Fines will normally be generated and managed by the LMS, either at the point of issue or on return. Clients may be prevented from borrowing items because they have exceeded maximum charge limits. RFID suppliers have a number of solutions available to facilitate financial operations ranging from separate payment stations to integrated units supporting payment technologies as varied as smart card and mobile phones through chip and pin to cash machines – with and without change facilities.

Some self-service stations have also been configured to support renewals - although this is often achieved by forcing a new loan rather than obeying the sometimes more complex rules for renewal supported by most LMS.

Self-service issue and return are the most common reasons for deploying RFID in the library. Many libraries however have found that the next application enhances their overall service in a more efficient way:

4.2 Automatic Sorting

Depending on the level to which SIP has been implemented by your LMS provider, returned items may be sorted into many different categories or indeed transported to different locations in your library. From a simple requirement to separate reserved items from the rest, through to complex sort and delivery operations for immediate shelving, or by just about any other criteria you may require. Self-return sorters are modular devices capable of extension to suit any library.

Typically,

- The borrower activates the return function via a touch screen
- Items are passed through a slot (resembling a letter box)
- RFID tags are read and checked to ensure:
 - it is an item belonging to the library
 - if it is a set, that it is complete
- SIP messages are exchanged with the LMS to determine the delivery location.
- Optionally a receipt is printed.

The system sorts the books using conveyors and bins. Staff may have to be on hand to monitor the system and to cope with any problems but the system should be expected to have the capacity to process all returned items without queues forming. Libraries should analyse their peak volumes and ensure that their RFID solution can cope with them.

4.3 Security

Security of its assets has long been a concern for librarians. Many methods have been developed over the last thirty years or so - the most popular is the “tattle-tape” solution originally created by 3M.

“Tattle-tape” uses an electrical current to sensitise or desensitise a thin strip of tape usually concealed in the spine of a book or otherwise secreted in an item. At the point of issue a high voltage charge is applied to the strip via a surface mounted device attached to a self-service unit.

Items have to be processed one at a time since the strips contain no intelligence and cannot identify themselves individually to the SSU.

Typically not ALL the stock is “taped” to reduce effort and costs but a high enough proportion are taped to provide the deterrent effect. The tape is hidden and as it is very small it is quite hard to find so there are fewer opportunities for customers to remove the tape and then steal the book.

RFID security is often thought to operate in a very similar way to Electromagnetic (EM) systems like “Tattle-tape” but is in fact completely different. It is nonetheless very simple to implement and, in the AFI version, uses standards-controlled data on the tag to determine whether an item may be removed from the library. There are two methods that are currently being used in libraries – EAS (Electronic Article Surveillance) or AFI (Application Family Identifier).

- *Electronic Article Surveillance (EAS)*: EAS encodes the status of an item on the tag in a similar way to AFI. EAS-based security is however entirely proprietary in its nature – each supplier implements EAS security in its own way. EAS is also unable to determine whether an item is a library item or not. In other words the alarm may be set off by an item which is not from the library e.g. a customer's shopping which has not had its tag de-sensitised.
- *Application Family Identifier (AFI)*: The ISO (International Standards body) issues AFI codes for RFID tags to be used in specific applications (such as in the pharmaceutical industry or libraries). This is what prevents a library book from setting off the security alarm in a supermarket.

When a library security system uses AFI, the security gate will request a response from any “checked in” library item. When an item is checked out, the AFI code is modified so that the tag does not respond to this request. Because only tags with an unmodified AFI code respond to the security reader, response rates are fast and reliable. Tags may also use multiple AFI codes to manage collections within collections e.g. to allow items to leave a short-loan collection but not to leave the library. However AFI – on its own – makes no distinction between items borrowed from different libraries. A book stolen from another library would still set off alarms in another.

RFID security requires designated exit routes which are monitored by suitably equipped antenna panels (in a variety of designs – or even built into the fabric of the building). These panels detect the security data encoded in each tag and trigger an alarm whenever an illegal operation is detected.

Gates are installed to detect that an un-issued item is passing the gates and will sound an alarm (or trigger some other action(s)) and may additionally report the item directly to the LMS. This enables the identification of illegally removed items whilst it is in the process of leaving the library. This can be useful in identifying which of several items is the one responsible for setting off the alarm. In a “worse case” scenario it will also produce a report of stolen items.

The range at which gates are capable of detecting items is determined by a number of factors. The size of the aerial, local environmental conditions (such as the presence of large amounts of metal or water) and the quality of tags and readers will all have an impact on performance. Typically gates will generate a signal all around the gate up to 0.75 metres giving a central aisle of 1.5 metres. This is obviously an important consideration when positioning the gates in the library. Some older libraries are constrained by local factors such as the architecture and fittings of the library and in these cases RFID may result in a degraded solution. It is important to discuss gate positioning and tag detection

rates with your supplier to ensure that the security element of your solution functions to an acceptable level.

CD and DVD security presents particular difficulties for many libraries. Tags attached to the actual discs are often too small to be detected by security gates (although tags with larger aerials are now available from some suppliers) and suppliers have been extraordinarily creative in finding solutions using lockable boxes, special packaging and even special dispensers to overcome the problem. Some libraries have abandoned CD/DVD security altogether. It is an area that will require a great deal of thought and consultation with suppliers, other librarians or those with professional expertise in this area.

4.4 Stock-management

As systems have developed and self-service has matured as an RFID service libraries have increasingly looked to other ways in which RFID may help them reduce costs, increase efficiencies and deliver better service. Suppliers have proved extremely eager to help them.

However, whilst self-service and security are largely controlled by well-documented and well understood protocols, the same cannot be said of any other aspect of library operations.

All this may change in 2010 with the adoption of a common data model (described in detail in Appendix B). All the major UK RFID providers have agreed to follow the example of many of their European counterparts and adopt a national data model for library RFID use. In effect this means the creation of a level playing field allowing both greater interoperability and competition between suppliers. A single data model allows libraries to pick the best combination of solutions rather than being tied to a single supplier. Libraries using the same data model can share resources more effectively – allowing for more cooperation between public libraries and easier inter-library loan management for all.

Until use of the standard becomes the norm – and use of the standard is not mandated – the status quo still applies.

In that light potential new investors in the technology should consider carefully a popular, but more complex aspect of RFID, use in libraries - the way in which it has been deployed for stock control and management.

Essentially a typical solution will comprise a scanning device attached to a data store. Typically the data store will be a PC, laptop or PDA.

Scanning devices come in a variety of shapes and sizes. Those with smaller aerials will create smaller fields and may perform better on more precise operations, larger aerials can read a larger area at once and may speed activities such as stocktaking. Some devices are claimed to be able to perform well for both types of operation.

The operations that may be carried out by such devices include (but are not limited to):

- Taking Inventory
- Identifying Lost or Missing Items
- Checking Shelf Order
- Finding Reservations

Some of these operations may be carried out simultaneously – with the device indicating the nature of any alert on a screen, or as a single operation.

The stock management unit may have an integrated aerial or be connected to a separate device. It may be a PDA, a laptop on a trolley, or a fixed PC –depending on the operations being carried out and the offering of the RFID supplier.

There are many different methodologies available to the librarian. The most popular ones are listed below:

Data is stored on the tags themselves

In this model software on the portable device processes data on the tags to determine what action to take, e.g. tags may carry a record of use enabling the device to calculate which are underused and may be weeded out.

Data is downloaded from the LMS and used to drive the stock management device.

In this model the tags carry the minimum of data and the supplementary information (e.g. title, classmark) is supplied by the LMS to the stock management unit.

Both approaches need careful consideration. The first requires careful data management if the accuracy and integrity of the library catalogue is to be maintained. Different RFID suppliers may recommend different data be stored – This is important to remember if you may switch suppliers in the future. The second requires that the necessary data can be readily supplied by the LMS.

In both cases there is likelihood that data will also be required to be uploaded to the LMS after collection. You should always ensure that your LMS provider is able to interoperate fully and efficiently with your chosen RFID solution.

4.5 Accessioning

With library servicing companies offering RFID “shelf-ready” stock the potential for automated accessioning has already arrived but has not yet been implemented according to the latest market survey.

The scenario is relatively straightforward. Servicing is carried out by suppliers – who will add RFID tags to supplied items. These are then packed into boxes for shipping. An additional tag – giving the number of items contained in the package – is affixed to each box before shipment.

On arrival at the library boxes are passed through an RFID enabled “tunnel” which reads all the tagged items in the shipment and verifies the total (it will keep scanning until it finds the right number of items). The data collected can then be passed to the LMS to automatically update item status, budgets etc.

4.6 Smart Shelves

Smart shelf solutions are now being deployed at a few locations in Europe – at least one in the UK. How smart shelves are actually used defines, in many ways, the current boundary between the LMS and the RFID system.

The concept behind the smart shelf is that items placed upon it are actively monitored at all times. The ways in which this information might be used are discussed in section 4.2 below.

5 Suppliers

The UK market is well served by RFID suppliers, with new companies appearing all the time.

In 2009 the “RFID Alliance” was formed by the UK’s leading providers - 2CQR, 3M, Axiell, Bibliotheca, D-Tech, Intellident, and Plescon Security Products – to promote the adoption of ISO 28560-2 for the domestic market.

Since then some of them have been keen to point out that, whilst they support the standard, they will always be prepared to meet individual client requirements if required to do so. This places all the responsibility for standards adoption on the individual libraries. Since use of the standard – and within that the UK data model – is entirely voluntary, it is for librarians to weigh the advantages and disadvantages of choosing not to use it.

A common data model is likely to attract new suppliers to the UK marketplace. There are many companies currently operating in markets where a national model is already in place that have, up until now, seen the proprietary nature of the UK library market – and its consequential dominance by a handful of suppliers – as too great a deterrent to setting up operations.

Increased competition and greater innovation may make choices of supplier slightly more demanding than at present but will also allow libraries to become even more creative in building RFID solutions.

6 Purchasing

There are many ways of acquiring RFID for the library. Most popular methods over the last few years have been framework agreements, using formal tender process, buying as an “add-on” to an existing LMS (no longer available) or by incremental hardware purchase.

There are – or have been – merits in all these approaches but 2010 will see changes that may make some of these options less attractive. To understand why here’s an overview of how each currently works.

6.1 Framework agreements

Framework agreements enjoyed considerable popularity at the outset of the RFID “revolution” in libraries. Their popularity stemmed principally from the perception – at the time – that RFID was in fact only a new kind of label rather than an entire technology. In the UK at least a fuller understanding of the potential – and the possible drawbacks – of deploying this technology has resulted in more and more libraries opting to carry out a more detailed tender process.

6.2 Formal Tender

The formal tender process has proved to be very popular with libraries wishing to make more specific demands about levels of service, types of equipment and even functionality. There are a number of different ways in which the formal tender process may be used – from services like “In-Tend” through to the full EU process.

A list of the key decision areas that should be addressed in creating a formal tender is contained in the guidance documentation⁸ published by BIC (Book Industry Communications) which may be freely downloaded from their website.

This approach often takes a radically different view of RFID – seeing it as a complete solution/system in its own right. In reality much of the functionality specified is currently delivered by the LMS rather than the RFID supplier. The limitation imposed by the proprietary nature of RFID tag data currently forces the library to choose a complete solution from a single supplier so a full specification presently offers the only opportunity to define overall requirements.

- RFID will help you deliver faster and more efficient self-service but it may inadvertently limit your options for future co-operation, change or development. This problem can be avoided by ensuring that the RFID solution and the library LMS interoperate fully and that the RFID supplier understands the importance of standards and can offer a cost-effective solution for any future re-programming of existing tags in the event of change. Ensure that your RFID supplier has a strategy for dealing with any changes to tag data, including any requirement for future re-programming that may be required to meet industry standards.

6.3 Incremental Hardware Purchase

As mentioned previously, early adopters of RFID saw it as a commodity to be purchased in much the same way as barcode labels. Only when systems needed replacement or updating did the limitations of a proprietary market become more apparent.

In 2010 the publication of ISO 28560-2 and the UK data model will, ironically, create the market conditions that many believed already existed. Buyers will now be able to buy both their hardware and software from any RFID supplier. This

⁸ <http://www.bic.org.uk/e4librariesfiles/pdfs/081124%20library%20guide%20final%20rev.pdf>

simplifies the procurement process – often allowing acquisition to be staged over a longer period – but may also make the selection process a little more complex.

Understanding what the standard is, and how the UK data model will work will be key to ensuring that suppliers offer standards-based applications in the future rather than the proprietary versions currently deployed

7 Considerations

7.1 Standards

All the major UK RFID companies have confirmed their willingness to adopt both ISO 28560-2 and the UK data model but since this is a voluntary agreement libraries should ensure that the solution proposed will use these standards.

ISO 28560-2 is being published in three parts. Part 1 defines the elements to be used and the values to be used in populating the fields. Parts 2 and 3 essentially define two different encoding methodologies for writing these elements to the tags. Part 2 uses a variable length model referenced by an Object Identifier (OID) which advises which fields are present and where they can be found. Part 3 uses a fixed-length model that closely resembles the existing model used by, among others, the Danes. The “Danish Data Model” is not quite the same entity as ISO 28560-3.

The UK (and most probably the USA, Australia and Holland) have elected to use the variable length version – ISO 28560-2. There seems to be a general consensus that the flexibility offered by this format will allow for greater creativity in building the systems of the future.

The full version of ISO 28560-2 allows for the use of up to 25 elements many of which relate to the progress and processing of the item to which it is attached **before** it reaches the library. There are also a number of elements that will only be used if suppliers choose to develop new functionality – like a fully self-contained circulation system for example.

The UK RFID committee therefore decided to create its own “profile” for the use of libraries in their day to day operations – and based on the premise that, for the moment at least, all decisions on loan policy will continue to be made by the LMS to which the RFID sub-system is connected.

There are therefore very few “mandatory” elements in the current “UK profile” or “UK data model”, the full listing of which is listed in Appendix B.

7.2 Communications

New RFID applications may not be built around existing LMS/RFID integration models. The SIP protocol that currently has to handle all communication between RFID devices and the LMS has already been identified as lacking the capacity to manage many of the new applications that RFID companies plan to develop using the new standard and a working party was recently created by BIC to define web services for some common library management routines in advance of the likely withdrawal of SIP altogether.

At the present time interoperability with LMS is limited to the use of SIP for self-service – which only requires the barcode number. As we move ahead with ISO 28560-2 the potential for using more data will change the way library functionality is delivered. Some RFID suppliers have anticipated this potential by developing their own (proprietary) means of utilising tag intelligence. By doing so they are creating solutions (and stock) that will only function with their RFID equipment. Moving to ISO 28560-2 will overcome this problem but just how LMS systems interoperate with expanded tag data is a discussion that is only just beginning. You should always ask your chosen RFID supplier and LMS provider how they plan to manage tag data in the future.

7.3 Privacy

There has been a great deal written about the supposed threat to individual privacy that RFID might represent.

Early library RFID solutions appear to have unwittingly been the source of much of this concern since suppliers – unsure of how best to deploy RFID in the library environment – added a great deal of largely redundant data to both item and borrower data models – some of it sensitive.

A typical library installation does not require borrowers to carry “in clear” personal data around with them. An individual’s identity remains secure within the LMS – as does meaningful item data - and both should only be obtained by matching the IDs stored in coded form on the tag against the entry in the LMS database – making the RFID enabled library as private as any other.

8 Migration

Tag manufacturing changes all the time. At least one library has already had to remove all tags from their books and replace them with a newer product when the manufacturer decided to discontinue the tags they had used.

Advances in UHF frequency tags may make them a viable option at some future date. How should you plan to cope with such a change?

If the new standard is widely adopted there will be a number of libraries facing the prospect of converting their tags to the new format. Many ways of achieving this have been proposed by suppliers but to date none have been implemented.

The solutions put forward mostly centre around the possibility of using multiple data models within a single collection. Self-service devices will be programmed to read (and convert) different data models as stock is issued. Under certain circumstances it may be possible to use two (or even more) models in the same stock for a period of time but this will cause difficulties for operations other than self-service. Libraries should ask whether their supplier intends to make the switch to the new standard and if so, what is the methodology to be used and what are the costs of doing so.

A fully documented migration strategy should form part of any successful bid in order to prevent the library from remaining in the “cul-de-sac” of proprietary systems and excluded from the exciting developments planned for the future development of RFID in the library.

9 Useful resources

- BIC – e4libraries Project
<http://www.bic.org.uk/e4libraries/>
- CILIP RFID Blog
<http://communities.cilip.org.uk/blogs/rfid/default.aspx>
- JISC List
<https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=LIB-RFID-UK>
- US RFID List
http://listsmart.osl.state.or.us/mailman/listinfo/rfid_lib
- Library RFID Ltd.
<http://www.mickfortune.com/Wordpress>
- LITA <http://www.lita.org/ala/mgrps/divs/pla/plapublications/platechnotes/rfidtechnology.cfm>
- NISO/NCIP
<http://www.ncip.info/>
- ISO 28560-2
<http://biblstandard.dk/rfid/>

10 Top Tips

- Ask suppliers about chip life expectancy to ensure that their solution provides adequate re-write cycles and durability.
- In planning for the introduction of self-service facilities careful thought needs to be given, among other aspects of the service, to overall traffic flows, security (especially where cash is involved) and peak demand for particular functions.
- Consider the relationship between RFID and LMS very carefully – it is the latter that remains in control of all policy execution.
- Analyse peak volumes and ensure that your chosen RFID solution can cope with them.
- It is important to discuss gate positioning and tag detection rates with your supplier to ensure that the security element of your solution functions to an acceptable level.
- Since the use of standards – including the UK data model – is entirely voluntary, it is for librarians to weigh the advantages and disadvantages of choosing not to use it.
- Ensure that your RFID supplier has a strategy for dealing with any changes to tag data, including any requirement for future re-programming that may be required to meet industry standards.

Appendix A: Glossary

Accessioning The process of receiving ordered items and registering them on the LMS as being “in-stock”

Aerial (Antenna) the means by which signals are sent to, and received from an RFID tag.

AFI (Application Family Identifier). A code that identifies the area of operation in which a tag has meaning – e.g. libraries. This differentiates tags used in libraries from by those used in supermarkets etc. and this prevents the false alarms which would otherwise occur where supermarket produce is read by library systems and conversely library book tags are read by supermarket systems.

Barcode A simple black and white representation of a number that can be read by a scanning device. There are many symbologies in use for encoding numbers in this way – libraries use a small subset of all that are available and can usually set their scanners to recognise more than one without impacting processing time.

e4libraries Project Book Industry Communication's project to assist libraries in the better exploitation of current technologies, standards and procedures.

EAS (Electronic Article Surveillance) A simple method of providing security on RFID tags. The EAS functions as a simple “on/off” switch

ISO International Standards Organisation

ISO 28560-2 A new standard, due for publication in 2010 that regulates the data format and content of RFID tags.

LMS (Library Management System) These are computer systems installed in libraries which are used to run library processes such as ordering, receiving and issuing stock etc. These systems manage the library and hold the stock and customer databases.

NCIP NISO Circulation Interchange Protocol – breaks the rules of acronyms by using an acronym within an acronym. Predicted successor to SIP. So far not deployed in support of RFID applications in the UK

Proprietary The opposite of “open”. Use of a model, format or application that cannot be ascertained or exploited without the owner’s consent. Proprietary systems are usually developed to provide the best solution for a particular application or hardware device. They have the disadvantage of preventing the use of tags, equipment or applications so designed with any other device.

Range The distance at which a signal may be read

RFID Radio **F**requency **I**dentification

Security Gates Usually panels set up to cover an exit point from a controlled area e.g. a library. These barriers have tag detection technology fitted and this can be used to read tags passing through or past these barriers. This enables RFID technology to provide a security function

Self Service Unit A device for use by library users to borrow or return items

SIP Standard Interface **P**rotocol. Developed to translate data exchanged between LMS and self-service units.

Smart shelves Library shelving that contains an RFID aerial connected to a reader capable of reporting the presence of items placed upon it in real time.

Tattle-tape A magnetised strip placed in an item that can be switched on or off to allow items to be monitored as they pass security gates. Not an RFID technology. Some libraries have RFID but still prefer to use tattle-tape because the strip is usually well hidden in the spine of the book and the system is reliable.

UHF/HF Frequencies used in RFID

Appendix B: “UK Profile” for ISO 28560-2

The Data Elements

1. **Primary item identifier**
Mandatory in library usage (optional if the profile is being implemented earlier in the supply chain)
In the library context the **primary item identifier** will normally be an existing barcode number.
2. **Content parameter**
Mandatory in 28560-2: the OID index, (OID is the abbreviation for Object Identifier) – in effect a list of data elements present on the tag.
3. **Owner library (ISIL)**
Mandatory as defined by ISO 15511
4. **Set information**
Conditional. Where an item is comprised of multiple components the element will be **mandatory**. Absence of data will indicate a single item.
5. **Type of usage**
Optional. Where used the values defined in Annex B of the draft standard – included at the end of this document – to be used.
6. **Shelf location**
Optional.
7. **ONIX media format**
Optional.
8. **MARC media format**
Excluded
9. **Supplier identifier**
Optional. Annex C of the draft standard suggests that this should be a national list regulated and defined by some national authority – BIC were nominated for this role in the UK.
10. **Order number**
Excluded.
11. **ILL borrowing institution (ISIL)**
Optional as defined by ISO 15511.
12. **ILL borrowing transaction number**
Excluded.
13. **Product identifier GS1**
Excluded.
14. **Local data A**
Optional.
15. **Local data B**
Optional.
16. **Local data C**
Optional.
17. **Title**
Optional. Although viewed as primarily a supply chain element 3M requested its inclusion as they use this data in many of their existing implementations.
18. **Product identifier local**
Excluded.

19. Media format (other)

Excluded.

20. Supply chain stage

Optional.

Valid codes:

16 Manufacturer

24 Publisher

32 Distributor

48 Jobber

64 Library

21. Invoice number

Excluded.

22. Alternative item identifier

Optional. May contain another identifier as deemed necessary. The only item that was at all contentious. Decision (by show of hands) was to include it as optional.

23. Alternative owner library

Excluded.

24. Subsidiary of an owner library

Optional. Was seen as essential to the future development of consortia.

25. Alternative ILL borrowing institution

Excluded.

Leading strategically, we promote best practice in museums, libraries and archives, to inspire innovative, integrated and sustainable services for all.