

# **Self-service systems in libraries: Final Report**

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Peter Brophy  
Project Director  
September 1996



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## 1. Executive summary

The SELF (The provision of self-service facilities for library users) Project commenced in February 1995 and completed its work in March 1996, the original 12 month schedule having been extended to 14 months. The project was funded as part of the European Commission's Libraries Programme and carried out by a consortium consisting of the Centre for Research in Library and Information Management (Project Co-ordinator) at the University of Central Lancashire, UK, the National Library for Psychology and Education, Sweden, and Dynix Library Systems, Ireland.

The original objective of the project, as stated in the Technical Annex, was to investigate the potential for the development of self-service IT-based services in libraries.

The enormous pressures on libraries of all types, arising from a combination of heavy demand and limited resources, have meant that there is great interest in a shift towards the concepts of self-service for users. Not only is open access stock becoming the norm, but a move towards self issue, self return, and self guiding is becoming apparent.

The development of IT systems based on client server architectures is opening up possibilities for much wider use of self-service facilities as the range of products and services networked in the library/user environment expands.

In this context, the project's specific objectives were:

- to assess user (library staff and library users) requirements in the area of self-service library systems and the implications of those requirements for future developments in this area;
- to examine the implementation of a self-service issue system and its operation so as to validate that requirements analysis;
- to explore the implications of the shift to open systems, and in particular the client-server model, for self-service systems and to identify the broad potential of such systems within the open systems environment;
- to develop a generalised functional specification for self-service systems;
- to identify areas requiring further analysis and development.

In addressing these areas, the Project Team has produced a set of publicly available Deliverable Reports and organised an International Seminar to disseminate the findings:

- User Requirements and Implications (Deliverable Report 1)
- Operational Analysis (Deliverable Report 2a)
- Open Systems Environment and Security (Deliverable Report 2b)
- Generalised Functional Specification (Deliverable Report 3)
- SELF Seminar: Self-service systems in libraries

Reference should be made to these Reports for specific details of the Project and of the work to be carried out.

In this Final Report, the Generalised Functional Specification is presented in detail, as the core output of the Project. To this description are added two examples of the development of applications of the Generalised Functional Specification, to inter-library loans and book issues.

The Report concludes with eleven specific recommendations which derive from the work of the Project:

1. Encouragement should be given to the development of a self-service library systems interface standard, which would enable the development of open products.
2. There is a need for integrated self-service systems to be developed, to replace the one-off products which are currently the norm.
3. Security issues need to be further considered, and in particular the adoption of more secure item identifier symbologies and technologies should be a priority.
4. New identifier technologies, such as 'active badges', may offer considerable promise for library applications as and when they become available at economic cost.
5. It would be helpful to have a broader range of open self-service systems on the market, providing more choice for librarians and market opportunities for new players. The EC may have a role to play in encouraging this competition.

6. Cheaper self-service systems (especially self-service issue systems) are needed to enable small libraries to participate in this approach.
7. There is little information available on the impacts of library self-service systems on users, on staff, on structures and on library layout. Work in this area should be encouraged.
8. Remote access to libraries and the enormous present and future growth of the Internet will present particular challenges to the development of self-service approaches: these need to be studied in detail.
9. Steps should be taken to encourage better physical design of self-service systems.
10. The needs of disabled users (especially those with visual impairment) should be considered and steps taken to adapt self-service systems for their use.
11. Further studies of the challenges to libraries from the change from printed material towards digitally stored information are needed.



## 2. Introduction and Background

Self-service has a long history in many service industries. Prominent examples of *Self-service in other sectors*, such as banking, retailing and the transport industry, were researched and the relevance of management, consumer, staff and systems issues raised in these sectors was considered with regard to the libraries sector. Indeed some have become so much a way of life as to be taken for granted. For example, telephone users now expect to be able to dial direct to any part of the world, while most petrol stations (or at least those in the main population centres) work on the basis that drivers will refuel their cars for themselves. Banking applications are numerous and ATMs (Automatic Teller machines) are now extremely widespread throughout Europe. Retailing offers many instances of self-service, with supermarkets now ubiquitous and self-checkout systems beginning to appear. Catering provides another example, with widespread acceptance of self-service going as far as drive-through fast food outlets. The transport industry in general has moved towards self-service, with the airlines taking a particular interest in the possibilities. Automatic Ticket and Boarding Passes (ATBs) use a magnetic stripe to code ticket, passenger, seat and baggage data and can nearly halve the time taken to process passengers at the departure gate, as well as cutting queues at check-in. Current EU passports, which accord with the international standard, contain machine readable data, although at present it is not widely used for immigration checks, and is of course no longer relevant for this purpose in the Schengen countries. The USA has implemented a system, known as the Blue Lane Advanced Passenger Information System, which captures this machine-readable data on departure so as to allow immediate clearance at the arrival airport. In theory these systems could allow a traveller to complete all documentation and other checks at both departure and arrival airports without intervention by airline staff or immigration officials.

Libraries too have embraced self-service concepts. Open access to library buildings leads to open access to many of their services, and users expect to serve themselves. Most obviously, open access to stock is now commonplace, with users taking it as a matter of course that they should be able to browse among the shelves and select books of interest for themselves. Many ancillary services also operate in this way: self-service coin- or card-operated photocopiers are the most obvious example.

However, many library services still operate on the basis of staff mediation. Self-service issue systems have as yet made only limited impact and there are many other services which have the potential for self-service. In a telematics-rich environment, with sophisticated computer-based library systems now almost the norm, self-service offers the potential for considerable economies. It also, if well-designed and presented, offers the

potential for improving services, offering greater choice, and extending the reach of library services beyond the immediate buildings.

The SELF Project was designed to explore this potential and to provide the basis on which self-service systems might be developed in Europe. The Project's Coordinating Partner, CERLIM, operates from within a medium-sized UK University. The National Library for Psychology & Education provides an example of a smaller library and one with a specific subject focus - yet with a much wider, national remit. The third partner, Dynix (Europe), offers a high degree of technical expertise in the library systems field and has a large number of installed library systems throughout Europe.

The Project's specific objectives were:

- to assess user (library staff and library users) requirements in the area of self-service library systems and the implications of those requirements for future developments in this area;
- to examine the implementation of a self-service issue system and its operation so as to validate that requirements analysis;
- to explore the implications of the shift to open systems, and in particular the client-server model, for self-service systems and to identify the broad potential of such systems within the open systems environment;
- to develop a generalised functional specification for self-service systems;
- to identify areas requiring further analysis and development.

Background analysis of self-service in other sectors led to the identification of a series of generic key issues which need to be addressed by any sector moving in this direction. These might be regarded as a checklist or agenda for library managers considering a strategic move towards self-service systems.

### Methodology

The SELF Project operated mainly through desk research, involving both individual studies and collaborative work between the Project partners. However, the first part of the Project also involved the installation of a self-service issue system, providing the opportunity to examine the specification, installation and operation of such a system at first hand. In addition the Project involved interviews and questionnaires with actual and potential users

of self-service library systems, together with discussions with experts in the self-service and networking fields. One of the Project partners, Dynix, being part of a major international company, was also able to draw on a wealth of expertise in a variety of world-wide locations. For dissemination, the Project relied mainly on reports but also ran a one-day seminar in Stockholm. Papers were presented to conferences and seminars. The Project Coordinator and one of the partners (NLPE) provided a Web presence.

### Management Issues

- *Management of Change*: a deliberate strategy is needed to achieve a successful culture shift among staff and customers to accommodate self-service as the norm;

- *Effects on Staff Structures*: because self-service tends to replace the more mundane tasks, a different type of staff may be required who will probably operate best within a flattened rather than hierarchical structure, especially as jobs as 'professionalised';

- *Training Issues*: not only will staff have to be trained in the operation and maintenance of the new systems, but customers will also have to be educated. The widespread acceptance of ATMs is a testament to how successful this can be when well planned;

- *Systems Management*: because systems are no longer in well-controlled spaces, and may have to depend on public or other non-owned networks, systems management is likely to become more complex. At the same time it may not be possible to provide a high level of redundancy and customers are known to be less fault-tolerant than staff;

- *Management Information*: it is vital that management knows how systems are being used and that the management information system is designed to accommodate self-service. At the same time self-service may open up new opportunities - the fully self-service supermarket may reveal not just what customers are buying but even the order in which they take items from the shelves;

- *Security Issues*: perhaps the most important of all. How can the equipment be made secure, how can information & services be limited to authorised customers, how can data be made secure, and so on.

## Consumer Issues

- *Ease of Use*: a general finding is that unless a self-service system is easy to use it will not be used. Customers will rarely try a system more than a very few times before giving up - and it will be hard to get them to try again even if the system is modified.
  
- *Privacy*: most users want to operate the system in privacy, not only to protect their private data but to avoid being overlooked should they make a 'mistake'. (It has been noted that one of the advantages of ATMs is that they avoid a customer having to reveal to a bank clerk what he or she is doing - especially when the transaction is a query to see if there are any funds in the account!)
  
- *Data Protection*: customers are now aware of data protection issues and are concerned that no unauthorised person should be able to access their personal details.
  
- *Reliability*: self-service systems must operate reliably. If the machine is frequently out of order then they will avoid using it. Other problems may arise: at one time queues formed at ATMs on Friday evenings because customers were sure they would run out of money before the end of the weekend.
  
- *Costs and Charges*: great care has to be taken over charging regimes, which can fundamentally alter user behaviour. This can of course be advantageous - one of the benefits of some telephone banking organisations is that they can levy reduced charges because of the lack of a branch network.
  
- *Public Awareness*: there is a threshold to be achieved where public awareness and acceptance of a new self-service system makes the proportion of use of that channel economic. Steps have to be taken to raise awareness to and beyond this level. System designers need to be aware of existing levels of public awareness so as to exploit them - for example by making a ticket issuing machine resemble the design of an ATM.

## Staff Issues

- *Relevance of Existing Skills*: all staff will be concerned as to the relevance of the person-to-person skills they have already developed.

- *Job Content*: this is not just an issue for management. Staff faced with the changes brought about by self-service will need to consider how their job content may change and how they can cope with that change through retraining or other programmes. For many staff, it should be emphasised, this is more a matter of new opportunities than a threat.

- *Staff Reductions*: this issue is raised again and again in all sectors. It seems likely that in libraries the scenario will be one of releasing staff to cope with the pressure of rising demand, not least in the provision of advisory services linked to networked information systems.

### Systems Issues

- *Integration*: because self-service systems are often produced by separate suppliers there are often issues of how they can be brought into the mainstream of the organisation's systems, without compromising security (see below). Self-service systems appear to have been produced outside the open systems framework in many cases.

- *Product Coding*: most sectors have reviewed product coding (e.g. barcode symbologies, magstripe cards, smartcards) in relation to self-service;

- *Networking*: for the reasons given above (and others) integration of self-service systems into existing networks is not always straightforward. In addition, it may be necessary for an organisation to hang 'its' self-service terminal on another company's network (as has happened widely with ATMs). This raises a wide range of technical and systems issues.

- *Security*: the biggest issue of all. Self-service has the potential to compromise existing systems, especially when it is introduced as the first public access point into those systems. Self-service in banks, retailing, etc. has spawned a considerable industry of security experts as organisations seek new and ever more complex products. Issues to be considered include authentication of the user, security of hardware, the prevention of hacking into networks, data privacy, item identifiers, building design, secrecy and so on.

These issues will all apply, to a greater or lesser extent, to library self-service systems.



### 3. User Requirements and Implications

The project undertook an assessment of libraries and their users in respect of self-service systems. This assessment consisted of a library requirements analysis, a user requirements analysis, and an investigation of security aspects of self-service, as this is regarded as a key issue which has to be addressed if self-service is to become the norm. Then a study of self-service in other sectors reported above was incorporated in this analysis.

The *Library Requirements Analysis* involved the analysis of key issues for a range of libraries (national, public, special, academic, commercial and government) moving to self-service:

- professional
- technical
- resource
- legal
- management

A functionality matrix was developed to explore these issues in relation to the services and functions offered by the range of libraries, and where there seemed to be particularly promising areas for self-service development, these were illustrated in self-service scenarios. An extract from the basic functionality matrix is shown on the following page (Fig 3.1). The Self-Service "Score" in the final column represents an attempt (by giving a score out of 100) to assess the feasibility of applying self-service principles to the function in question. Where the function appeared to hold out promise, the Consortium developed a brief scenario of how self-service might be applied: these are given in Deliverable Report 1, which also included a bibliography of material of relevance to the areas covered in the report<sup>1</sup>. A summary of the scores awarded is given in Table 3.2 below:

FUNCTION	SCORE
Acquisitions - books	50
Acquisitions - journals	10
Acquisitions - equipment	0
Display of new books	100
Addition of "photocopied" material to stock	100
Catalogue enquiry (OPAC)	100
Catalogue record - procurement	90
Catalogue record - amendment	20
Open Access to Stock	90
Archive maintenance	10

<sup>1</sup> All Project Deliverable Reports are available from CERLIM, University of Central Lancashire, Preston, PR1 2HE, U.K. Fax: +44-1772-892937; Email: l.cerlim@uclan.ac.uk). See page 119 for details of titles.

Ordering from closed stacks	100
Issues (Loans)	100
Overdue Reminders	100
Reservations	100
Renewals	100
Returns	30
Payment of fines	100
Reshelving and Finding books	10
Information - personal loan records	100
Information - access to local databases	100
Information - access to remote databases	100
Bibliographies on demand	100
Current Awareness Services	100
Equipment (booking)	100
Study space (booking)	100
Guides to the Library's services	100
Information skills training	100
Interlibrary loans - books	100
Interlibrary loans - photocopies	100
Joining the library	100
Information -operational	100
Subject enquiries	50
Remote Access	60
Complaints and suggestions	100

Table 3.2 Self-service "Scores"

A series of *User Studies* was undertaken to include users in the analysis of self-service functions for libraries. The studies included:

- interviews with library staff in 2 UK libraries which had implemented self-service systems;
- interviews with, and questionnaires sent to, library staff and library users in Sweden and the UK which had not yet introduced self-service systems.

The results of these surveys were incorporated in Deliverable Report 2a, and are summarised in the next Chapter.

<i>Issues</i>	<b>Professional</b>	<b>Technical</b>	<b>Resource</b>	<b>Legal</b>	<b>Management</b>	<b>Self-service score</b>
<b>1. Acquisitions</b>						
<b>Acquisitions - books</b>	Book selection control; balance of stock; selection of databases as acquisitions tools; electronic publishing as alternative; user needs.	Identification of correct titles; user interface; security and authentication; budget control; link to catalogue record procurement	Control of expenditure; cash flow; materials flow	Authorisation: status of contract for books etc.; audit trail	Control of collection (e.g. maintenance of balance, level of stock etc.); implementation of collection management policies;	<i>Score: 50 Library type: ALL, but particularly relevant to academic and corporate + some public</i>
<b>Acquisitions - journals</b>	Journal selection control; balance of stock; selection of databases as acquisitions tools; electronic publishing as alternative; user needs.	Identification of correct titles; user interface; security and authentication; budget control.	Control of expenditure; cash flow; materials flow; ongoing commitment	Authorisation: status of contract for journals etc.; audit trail	Control; need for review at regular intervals	<i>Score: 10 Library type: ALL, but particularly relevant to academic and corporate</i>
<b>Acquisitions - equipment</b>	Assessment of user need in relation to services provided	Standards; Installation; Maintenance	Control of expenditure	Authorisation: status of contract for equipment; audit trail	Control; assessment of need; replacement strategy	<i>Score: 0 Library type: ALL</i>

Table 3.1: Sample matrix

Security issues are paramount for libraries, as for other sectors, and the Project Team went to considerable lengths to analyse these from the operational viewpoint (see Chapter 7 and Deliverable Report 2b for systems issues). The following paragraphs summarise these issues:

1. It is first necessary to acknowledge that library books differ from cash and loaves of bread in that libraries need to identify and secure each individual copy, and it has to be assumed that each copy may go in and out of the Library many times. This provides a layer of complexity that is not present in many other applications.

2. Authentication will normally consist of a check that a potential user is eligible to use the library, the issue of some kind of identification and the insistence that transactions which involve borrowing etc. (i.e. a potential cost to the library) can only take place if the identification is produced. Many libraries now include the user's photograph on the identification card. Cards may be required to gain access to the Library itself (the most basic form of self-service). However, as the shift towards self-service becomes ever more pronounced, additional features will be required:

- since there is no member of staff present to check user authentication at the issue (or whatever) point, some alternative to the photograph is required. This may be a PIN or a personal feature such as date of birth. More sophisticated methods, such as retina identification, could be used if research and development by banks and other sectors makes them feasible and affordable. It should be noted that for some transactions (such as returns) libraries do not operate any identification, since the borrower may not always be the person to return a book.

- co-operation between libraries leads to the need for common membership and thus authentication between different library systems.

- as more and more services become available which incur a charge, the authentication needs to incorporate some kind of payment or credit status. Online journal article delivery services offer to provide copies in exchange for a credit card number. Unfortunately for these services, there are few customers willing to make such details available at the present levels of security over the Internet or research networks. What is needed is a means of reliably identifying the customer and linking that information to the customer's credit status.

- authentication assumes that time limits will be set on membership. This is usually operated by libraries, but adds a layer of complexity into systems design where the

variety of services (in-house and off-site, for example) has grown, or where the identifier covers more than one library.

It should be noted that current technology such as magnetic stripe cards and barcodes, which are far and away the most common type of identifier used by libraries, are unlikely to be adequate for all these purposes. For this reason a shift towards the use of smart cards must be anticipated.

3. The physical security of hardware needs to be given attention. It is not unknown for PCs to be stolen from libraries, which at the very least causes inconvenience and could lead to the loss of valuable software and data. It is interesting that 3M, for example, strongly recommend that the PC which runs their self-service issue system should be kept in a locked cupboard, and this would seem to be a sensible precaution for any such equipment where library staff are not in attendance and the user does not need access to the systems box.

4. Telecommunications needs to be given some thought (although this also applies to staffed services on networks). It is common for library systems to sit on local area networks shared with other applications. Universities, for example, may use a common network for student use and library purposes. The risks inherent in this situation need to be assessed. However, it also needs to be recognised that library systems are not as sensitive as, for example, financial services, and that security considerations alone probably do not justify separate networks and other elaborate telecommunications-based safeguards.

5. Software needs to be written with security in mind. A number of points need to be considered:

- The very earliest self-service issue systems were operated by users filling in loan slips, but were tedious for users and time-consuming for staff. Early IT-based self-service issue systems were designed on an outdated technological basis (for example, at the time of writing the first version of this Report, 3M's issue system has only been released in the UK with an RS232 interface, although ethernet connectivity was provided by summer 1995). Once LAN interfaces become available, and client-server designs are implemented, precautions need to be taken to prevent other LAN users accessing systems without authorisation using a common client. Careful thought is needed to achieve this. However, it should be noted that client-server access where the communications protocol itself restricts the range of functions that can be carried out is intrinsically more secure than where OPACs or other self-

service systems have to be logged in to the system. Online OPACs have sometimes had security breaches where much greater access to the system than planned was achieved. Such breaches are virtually unknown using Z39.50 clients.;

- the central library system needs to be secure, especially where it is provided with an Internet connection, as may be the case where off-site access is being provided. A "firewall" and monitoring software may be needed to prevent unauthorised access and hacking;

- software needs to incorporate varying levels of authorisation. For example, some users may be given read-only access while others may have write access. Read-only access may be stratified: an example would be a commercial database (such as FT-Profile) containing market research reports, where full access might be charged at very high rates. The software developed needs to be able to check the individual users' authentication (see point 2 above).

- use of intelligent monitoring software. This can help detect security breaches by looking for transactions which are unusual for a particular type of user (see 7. below).

- data privacy must be protected. No user should be able to access another patron's record or transactions.

- software should ensure that no user is able to access the library database except those parts specifically designated for public access.

- software should maintain a record of the location of each transaction (e.g. which self-service issue point was used). This enables tracking of individual transactions but also helps to pinpoint security weaknesses in systems.

- there is a particular problem for libraries where systems and services are bought-in rather than run in-house. Libraries will need to be sure that security is adequate before opening up access to such services. There have been major problems in the past from commercial services which once accessed do not provide adequate security.

6. It is not unknown for library users to switch barcodes between books. With self-service systems there is no opportunity for staff to note any signs of this happening. Further work is needed to find ways of welding bar codes (or other identifiers) into place in such a way that they cannot be removed from books, and to prevent duplication of identifiers.

7. Precautions need to be taken to identify suspect transactions and to verify the status of user identifiers (for example lost cards). An example of the former might be a university student apparently borrowing frequently from a subject collection distant from the subject he/she is studying, although with modular degree schemes this becomes more common.

8. The design of library buildings may need to be rethought to cope with self-service security issues. In particular, security at exits and entrances has to be tied into the systems in use. This may raise particular issues where more active security systems are in use than is currently the norm.

9. Staff training is important when self-service is introduced. Staff need to be fully familiarised with systems and to have a briefing on possible causes of security breaches.

10. User training is also important. Not only do library users need to be urged to keep PINs secure, but the operation of systems needs to be explained clearly to prevent unwitting breaches of security. An example of this occurs where not all the stock of the library is security tagged: users need to be persuaded not to forget to have all items issued either by self-service or through staffed points.

11. Thought needs to be given to the back-up procedures in place and whether staff overseeing exits need to be provided with additional information sources. For example, at present many libraries would rely on the date stamped in a book as "proof" that it had been issued: this is not available from a self-service point.

12. Just as supermarkets issue itemised receipts and ATMs offer the facility, it is probably a good idea for all library self-service transactions to be receipted. This gives the user confidence that the transaction has been properly recorded.

13. It seems likely that, as in retailing, particularly valuable items should continue to be secured by physical barriers and by staff intervention. From a security viewpoint, self-service should not be extended to such items.

14. As in other sectors, management action is very important. There needs to be an overall management responsibility for security both in the design and implementation of systems and in their operation. At the same time, all staff need to be trained to be security-aware. Security should be reviewed at regular intervals.

15. It is important that users are not given details of the security features of self-service systems. Although the technologically-aware user may well be able to work out many of these features for him/herself, a considerable level of security is achieved by promoting uncertainty.

16. Some libraries are now implementing systems at library entrances which require that the library card be swiped before an automatic turnstile will allow entry. This can prevent non-members of the library gaining access to the building. When interfaced to the library system it can also prevent members with defined blocks from entering the library.

17. One method of circumventing the security measures in self checkout systems has been to check one book out while desensitising two. The physical design of the station must prevent this.

## 4 Operational Analysis

One of the major objectives of the SELF project was to monitor the effectiveness and efficiency of a self-issue system by means of a case study at the University of Central Lancashire. The system was chosen on the basis of the system specification outlined in deliverable 2a, which to summarise briefly states that the system must enable users to issue books entirely without staff intervention, must operate with the University's Library automation system (Dynix) and 3M security equipment without compromising Library security and must support future development in standardised communications protocol and functionality. The 3M Self Check System (5210) was purchased in the first quarter of the project, although at that time the system was only available with a serial communications interface. This limited the positioning of the system as a special asynchronous line had to be installed by the university network team. Fortunately the building had previously housed computers requiring similar interfacing and use was made of existing multiplexers. This problem was less evident when the Library re-located to its refurbished building during the third quarter of the project since the new library had been rewired in universal twisted pair (UTP) and this standard would allow serial communication. Subsequently, 3M announced the availability of an Ethernet interface (see below).

The self-issue system was initially installed alongside the OPAC computers on the first floor of the Library. However this location proved unsuitable and failed to attract patrons who had selected items from other floors, since the self-issue system was not on the main route to the issue desk, especially if patrons used the lift to access other floors.

The self-issue system was re-located to the ground floor adjacent to the issue desk. This had the advantage of offering the service in a prominent location, easily seen from the queue for the issue desk and offering patrons time to digest the various promotion material around the system. It also meant that library staff were available to assist users - a crucial factor in early stages of system implementation.

During the period of the project, 3M were developing a networked version of their communications software. This meant that the computer that controlled the various components making up the system could talk directly over the campus network to the Unix machine hosting the Dynix Library software. The advantages of this include:

- Allowing the location a self-issue system anywhere there is a network point (important for the future enhancement of the service e.g. a number on each floor of the Library);

- Network usage figures are available from the university network management accounting system, assisting in system management;
- Better fault tolerance;
- Network faults are more easily traced or monitored.

However, one particular (and serious) problem was encountered. The network protocol used by the system was TCP/IP (transmission control protocol / Internet protocol) while the topology of the university network did not allow IP access from local nodes through the gateway to the Unix system, because direct Telnet sessions will not pass through the gateway which acts as an 'internal firewall'. As this may be a problem for other sites it is dealt with in more detail below.

The university network has evolved with security as a very high priority, and for this reason the network is divided into two halves using different networking protocols, IP and IPX :

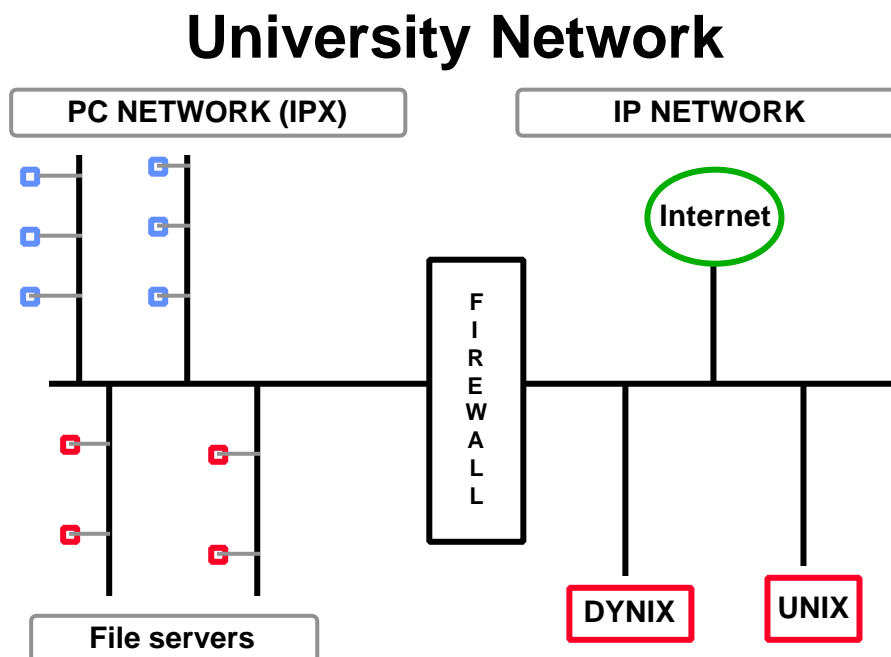


Fig. 4.1

This networking arrangement controls the access via the 'firewall' (gateway servers) to the Unix based system on the IP side of the network. This is achieved by server software running on the gateway servers, so that Novell Netware NOVIX (Novell IP/IPX) will only establish a connection to the IP network from a windows client using the correct Winsock.dll. The windows client must be a registered user on the PC network to have access to the client application (Firefox). PC users cannot directly Telnet to an IP address on the IP side of the network.

The 3M system (and it is by no means alone among commercial applications) uses the IP protocol to communicate to the host computer, using a direct Telnet session, and non-windows based software: the 3M PC requires its own IP address. As a result the system failed to communicate to the host computer. To implement this configuration the physical wiring characteristics of the network would have to be altered. The PC network covers the whole campus while the IP network is physically contained within the Computing Services department, and the IP network would have to be physically extended to cover the library building. This would seriously compromise network security since a PC could then be plugged into the self issue network outlet and Telnet access could then be possible around the world from an illegal IP source.

During the Project, the 3M system was installed on the IP network for a short period to evaluate the software and the system worked well with no networking problems. Many institutions would be able to implement the system with this configuration in their networking environment, but others have a network topology similar to the University of Central Lancashire, and would encounter similar difficulties.

The University of Central Lancashire's solution was to revert back to serial communications protocol installing a direct asynchronous line to the host machine (see fig 4.2). This is seen as an interim solution until 3M develop a windows based version of the self issue software.

## University Network

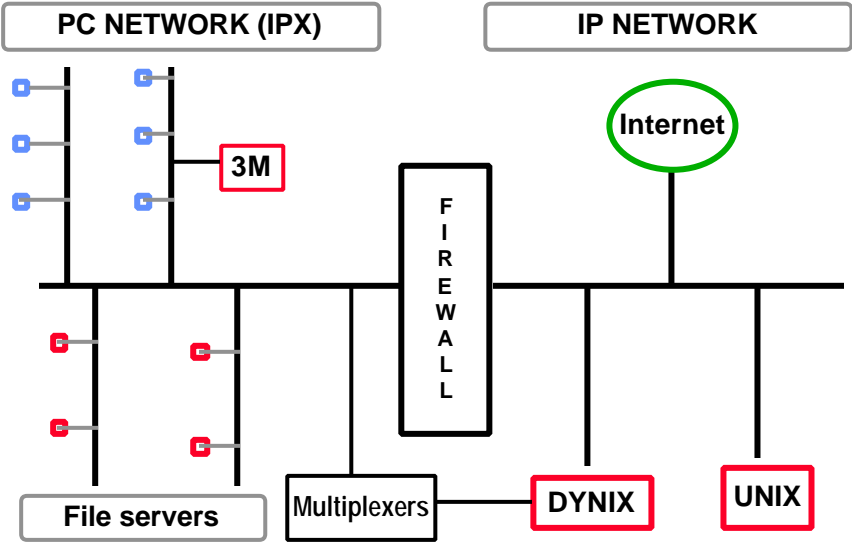


Fig 4.2

The operation of the self-service issue system was monitored carefully during its initial operation to determine whether there were significant operational, user training, staff training or other

managerial issues. This monitoring was supplemented by analysis of statistical data from the system, interviews with staff and users and a survey of users. In addition user feedback forms were put in place, with a monthly prize draw for those who returned completed forms with their comments. Because the evaluation initially took place during a very quiet time for the library (the summer vacation) a decision was made to extend monitoring to the end of the Project.

Feedback was gained from library staff and users by the use of survey forms, each completed form was studied and results recorded (see Deliverable Report 2a). The user survey was ongoing throughout the life of the project, and the results are summarised in Fig. 4.3 on the next page. The points raised can be summarised as follows:

- The best thing about the self issue system for users was the speed factor: there was no queuing and it was easy to use.
- The worst aspect for users was the barcode positioning (having to line up the book barcode to the scanner to read). The options for this are discussed at length in the Report.
- Users expressed a number of comments about the detailed design of the system, including the unfamiliar interface and the complexity of ensuring the transaction was properly completed.
- Some unexpected benefits accrued, such as the deaf user who found self-service a great advantage over having to communicate with a member of staff.
- The general feeling was that all the users were pleased with the introduction of a self issue system, would use the system again and would welcome the introduction of other self-service systems.

Although we had decided not to re-barcode the stock for the experiment this is a question which needs careful consideration, and a number of other libraries have decided to take this route. For the experiment we wanted to test whether users could cope with barcodes inside the books: the comment above indicates that while it is feasible to offer the service in this way, there are major advantages in having the barcode on the outside of the book. Not only does this make the issue procedure much more foolproof, but it simplifies a number of other procedures such as stocktaking. Of course, many European libraries already affix barcodes in this position, so that the question does not arise for them.

Features		Negative Feedback -	Neutral/ Suggestion	Positive Feedback +
<b>Access</b>	<b>Equipment</b>			
	- location	4	1	-
	- quantity	1	2	7
	- modernity	7	1	2
	<b>Efficiency</b>			
	- queues	-	-	43
	- speed	2	1	51
	- staffing	3	1	1
	- self control	-	-	3
	<b>Ease of use</b>			
	- interaction	4	-	3
	- special needs	3	-	1
	- privacy	-	-	1
<b>Design</b>	<b>Interface</b>			
	- instructions	3	-	6
	- error messages	2	-	-
	<b>Equipment</b>			
	- desensitising	1	-	-
	- item / ID card / barcode positioning	22	-	-
	- reliability	4	-	-
	- excluded/ non- standard items	7	-	-
	<b>Security</b>			
	- card security	1	-	-
<b>Facilities</b>	<b>Receipt</b>			
	- receipt	-	-	10
	- loss potential	13	-	-
	- items per receipt	1	-	-
	<b>Other potential self-service facils.</b>			
	- returns	-	11	-
	- fines payment	-	11	-
	- inter library loans	-	11	-
	- reservations	-	4	-
	- viewing current/ out-standing loans	-	7	-
	- restricted loans	-	1	-
	- record updating, e.g. change of address	-	2	-
	- room/equipment bookings	-	1	-
<b>Questions</b>			<b>Yes</b>	<b>No</b>
<b>Q. Do you object to your name being displayed on screen?</b>			15	59
<b>Q. Will you use the self-service issue system again?</b>			70	3
<b>Q. Does the receipt display enough information?</b>			59	10
<b>Q. Does the self-service issue system serve a useful purpose?</b>			69	4

Fig. 4.3

A proportion of the book stock at the University of Central Lancashire has more than one security tag, and this causes problems for the self-issue system because of the multiple book detection option. This is configurable and can be switched on/off but ideal solution is to run the system with multiple book detection on. However with the current level of book stock containing more than one tag still high enough to disrupt service to patrons (especially patrons taking more than one book out) it was felt that the option should be disabled until the book stock could be 'weeded' and the older books with more than one tag withdrawn. The system also has a 'suspicious patron handling' option, which senses if items have been moved around on the cradle or if an attempt to swap an item during a transaction. As a result the patrons' library card will be disabled or the transaction ended depending the choice of configuration taken during the set-up routine.

Late in the Project a further problem, with potentially serious consequences, was identified. It became apparent that it would be possible to use the system to remove books illicitly from the Library by photocopying the barcode from another book. Although no other site was known to have suffered from this problem, it was felt to be sufficiently serious that the self-service issue system should be withdrawn. At the time of writing solutions to this problem are still being investigated, but re-barcoding with a 'non-photocopiable' barcode or other item identifier is the most promising solution.

The results of the experience of self-service issue at the University of Central Lancashire and of discussions at other libraries may be summarised as follows:

On the positive side:

- there was generally a high level of acceptance among users;
- self-service issue definitely reduced queues and waiting times for users;
- staff workloads were likewise reduced;
- self-service issue can be location-independent, making issue much more convenient for users and enabling a fundamental rethinking of library design;
- one group of users was particularly delighted with the system: those who are deaf. They had found a way to use the library without having to make their impairment known to staff.

On the negative side:

- there is a very limited choice of systems on the market, especially when interfacing to an existing library system is required;
- systems are not well-designed as physical units;
- they are poorly integrated with other library systems;
- the technology previously used by the library (e.g. reader tickets with barcodes) is not necessarily the most appropriate for self-service;
- systems are entirely inappropriate for disabled users, especially those with a visual impairment;
- care needs to be taken over privacy issues (e.g. identifying the user on the screen);
- there is an element of 'double queuing' for users, where they try to self-issue an item and are told they cannot because of a 'block' on their record or that of the item in question - they then have to join the queue at the staffed issue point;
- the lack of interface standards and especially the lack of application of open systems principles is a major obstacle;
- self-service systems are more vulnerable to the theft of books than staffed issue points.



## 5 Generalised Functional Specification

### 5.1 Introduction

A major output of the Project was the Generalised Functional Specification. This is presented in full here.

#### 5.1.1 Purpose and Objectives

The purpose of self-service systems in libraries is defined as the provision of a range of unmediated services to library patrons. In other words, patrons should be able to gain access to such services and complete the transactions they select without recourse to library staff. The main motivations for developing self-service systems in libraries are:

- to lower the workload of staff by the automation of routine processes and thereby to increase the efficiency of library operations;
- to increase the range of services available to library customers;
- to make services available from locations which are more convenient for library customers.

#### 5.1.2 Scope

The SELF Project, and the generalised functional specification, is restricted in areas of functionality as follows:

- Self-service within libraries.
- Access from homes/businesses etc. into libraries
  - Via public access networks e.g. Internet
  - Via other electronic media e.g. PSTN

Provision of access from a library out to public access networks is not considered.

The specification is restricted to the current situation in the information world in which libraries, with collections of physical information artefacts, form a key element of the information universe. The ultimate self-service system might involve a home work station which would provide direct access to all information and knowledge required with no requirement for access to libraries. We do not seek to specify the functions of such a workstation.

### 5.1.3 A Generalised Functional Specification

The generalised functional specification is intended to provide an analysis of actual and potential self-service functions in terms which will be helpful to librarians and to the developers of such products. The approach taken has been to undertake a multifaceted analysis of the functions identified in earlier project reports, taking into account the issues raised by open systems requirements and the specific, key issue of security (as discussed in Deliverable Reports 2a and 2b). On this basis a modular approach has been used to demonstrate both the common and function-specific requirements of each function.

## 5.2 General Overview

### 5.2.1 Product Perspective

Self-service systems in libraries will operate in a telematics-rich environment. It is assumed that the library will have access to, and will wish to make use of, a number of telematics products and services in delivering its services to the users. Self-service systems will, at the minimum level, be compatible with these systems and further may be integrated parts of such systems.

#### 5.2.1.1 Library Automation Systems

The self-service system will be integrated - as defined later - with the central Library Automation System (LAS) which will be used to maintain a database of registered library users and of library materials. It should be assumed that the LAS will be designed in accordance with open systems principles (see Deliverable Report 2b). The LAS will itself need to communicate with a variety of other computer-based systems, for example other libraries' LAS, financial systems, bibliographic and other database systems. Some self-service sub-functions may be carried out by sub-systems which are best treated as separate systems for system design purposes, and which must therefore conform to open systems networking standards themselves.

#### 5.2.1.2 Internal networks

The internal networks of the Library will provide the functionality to permit the LAS and other systems, including end-user workstations, to interact. Self-service systems will make appropriate use of this networking functionality. On the

assumption that appropriate open systems and/or *de facto* standards have been used, self-service and other systems will interact within the internal networking infrastructure.

#### 5.2.1.3 Public access networks

Because libraries operate multiple branches and because they wish to provide access to their services by remote patrons, public access networks will provide part of the infrastructure used by library systems. Self-service systems may be required to use the functionality of public access networks to link to the LAS or other library systems.

#### 5.2.1.4 Security hardware

Security of stock being a particular issue for libraries, hardware may be provided to switch security triggers on and off in relation to usage permissions. Self-service systems will integrate (or at least access) this switching capability as necessary, and will ensure links to LAS functions are maintained.

### 5.2.2 General Constraints

#### 5.2.2.1 Standards

The level of standards development in this field is covered in Deliverable Report 2b, to which reference should be made.

#### 5.2.2.2 Hardware and technology limitations

A number of issues need to be considered, which affect the functionality which can be provided at this stage of development. In general the limitations of computer hardware and software, and of networking, relate to lack of standardisation and poor level of implementation. Again, in general, LAS development lags behind that of other mainstream systems - witness the as yet poor market penetration of true client-server systems.

Security system development is also currently at a plateau, with little technical innovation apparent during the last few years. For example, we suggested in Deliverable Report 1 that remote sensing devices could hold out the future for self-service issue and return functions. Discussions with the manufacturers of such devices have shown that it will be five to ten years before they have developed to a

state where they are suitable for implementation in library systems. It appears that current technology will have to suffice for any medium term developments.

The technical basis for self-service is further considered in Chapter 6 of this Report.

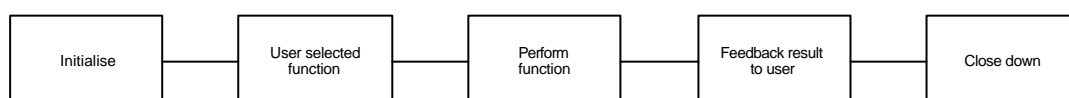
### 5.2.2.3 Current level of LAS development in this area.

Reference should be made to the discussion in Deliverable Reports 1 and 2a.

## 5.3 Categorisation of functions

### 5.3.1 Introduction

At the extreme a generalised functional specification, in order to be valid, could contain very little information about specific functional requirements. The generalised specification might be:



While this level of generalisation allows for functions which require the user to be identified uniquely to the system, and those that do not; for functions that require access to the LAS' bibliographic database of library holdings, and those that do not; functions which include the handling of a physical object, and those that do not; and so on, it is not of much help to librarians or systems developers.

In order to progress beyond this level of generalisation, we have carried out detailed 'bottom up' analyses of all the self-service functions identified for libraries, with cross-referencing from non-library self-service functions. Deliverable Report 1 sought to list and illustrate library functions to be provided through self-service systems. In this Final Report, following this further analysis of systems functionality and dependencies, we categorise library self-service systems functionality in accordance with four characteristics:

	<i>Characteristic</i>	<i>Categorised by reference to</i>	<i>Section Reference</i>
1.	Library functions	User access	Section 3.2
2.	Operational functions	System requirements	Section 3.3
3.	Inputs	Input type(s)	Section 3.4
4.	Processes	Process module	Section 3.5

*Library functions.* We have defined 41 library functions which may be suitable for self-service on the basis of analyses carried out during the SELF Project. It is not claimed that no other functions could be defined. However, the analysis presented in this Report is sufficiently generalised to permit new functions to be added should that prove necessary. In our first categorisation, we divide these functions into three areas (as indicated below) on the basis of user access to library materials and services. Thus, some functions can be carried out remotely (e.g. from home or office) because they do not require access to physical resources - these functions can of course also be carried out in the Library (section 5.3.2.1). In the second category (section 5.3.2.2) there are functions which can normally only be carried out in the Library because the user is expected to access the physical artefact. However, if libraries make special arrangements some of the second class of function may be carried out remotely, for example by special groups: this is the third category (section 5.3.2.3). This categorisation affects the design of systems fundamentally, and we therefore define functional specification subsets according to it.

*Operational functions.* By examining each of the 41 functions defined in this Report, we have been able to devise a categorisation of operational functions (systems requirements) according to seven system attributes. These include the complexity of user interaction and of data structures, the requirement for database updating, whether or not personal information is handled, whether the requirement is for intra-system or inter-system operation, or both, and whether physical artefacts (such as books) and payment need to be handled. These attributes are detailed in Section 5.3.3 below.

*Data Inputs.* The type of input required by each function is a key consideration, and we have generalised the analysis of all inputs to the 41 functions into seven types. These are described in Section 5.3.4 below.

*Processes.* The generalisation of processes has been based on a detailed examination of the 41 functions to determine the number of discrete modules (which might also be considered in system development terms as subroutines) required. 26 modules have been defined, and are described in Section 5.3.5.

### 5.3.2 Categorisation by user access

#### 5.3.2.1 General self-service functions provided both within the library and from remote locations

The following functions can be provided on a self-service basis both within the library and by users accessing the library from outside (see also the functionality matrix of Deliverable Report 1). Note that the implementation for internal library use may differ considerably from that used for external access.

	<i>Function</i>	<i>Comments</i>
F1	Selection of books and other materials for purchase by the library	Some implementations can be found, but require staff intervention to authorise the function. There are no theoretical problems to overcome, although security and financial control are important considerations. Ideally should be linked to teleordering.
F2	Display of new books using imaging technology	Copyright problems could be severe if more than cover and table of contents is required.
F3	Addition of electronic pages to the library's stock	Copyright problems are likely to dominate
F4	Catalogue enquiry	Already very widely implemented, but may provide a gateway to other functions
F5	Join library	User identification and subsequent authentication pose the major problem
F6	Overdue reminders	Already widely implemented. Automatic email/telephone systems are just starting to emerge
F7	Reservations	Widely implemented
F8	Renewals	Widely implemented
F9	Payment of fines and other charges	Few implementations, but ecash and other networked payment methods hold out promise for development

F10	Information on & amendment of personal records	Information widely implemented; amendment less so, but should not be problematic if user has PIN
F11	Access to local databases	Widely implemented but on a limited scale. More development needed on interfaces in particular.
F12	Access to remote databases	As F11, but added issue of payment may arise.
F13	Bibliographies on demand	Available on many local systems, but transparent integration between systems needs development
F14	Current awareness services	As F13
F15	Booking of equipment for later use	Basic systems widely implemented, but could add graphics/video to improve usability
F16	Booking of study space for later use	As F15
F17	Guide to library services	Widely implemented for text-based products, but could be extended to multimedia to improve usability.
F18	Information skills training (part)	Little yet available apart from local/experimental systems. Much scope for multimedia approaches
F19	Ordering of inter-library loans	Not generally available. User-generated requests and automatic transmission need further development. Note also contractual issue, but parallel of commercial services.
F20	Delivery of inter-library loans (photocopies)	Technically straightforward, but copyright problems prevent widespread implementation
F21	Community Information	General information about community activities and groups is available on some library systems. With appropriate security, self-updating can be implemented.

F22	Operational information	General information about the library - its membership categories, opening hours, loan periods, regulations, etc. Could use multimedia approaches for improved usability.
F23	Complaints and suggestions	Could be linked to email for replies
F24	Ability to review items already read.	Requires systems to maintain record of loans beyond what is usually provided, but not difficult in systems terms.
F25	Ordering of electronic documents	Available on commercial systems, but not yet well integrated into library systems
F26	Delivery of electronic documents	Copyright problems remain the major constraint, with systems reasonably well-developed. Standards issues continue to need attention.
F27	Ordering from closed stacks	Implemented on a number of systems. Date/Time specification for remote users may need development.
F28	Subject enquiries (part)	Implemented on some systems, but 'negotiation' element not yet satisfactory (see F38). Video links could add to present functionality.

### 5.3.2.2 Functions normally provided only in the library

	<i>Function</i>	<i>Comments</i>
F29	Open access to stock	Recording user access within LAS not widely available
F30	Ordering from closed stacks	See also F27. Has been implemented as an in-library function.
F31	Issue of books and other materials	Considerable number of systems becoming available, but further development needed.

F32	Book and other materials returns	Only one commercial system, covering part of the process.
F33	Automatic sorting and reshelving of books	Mechanical handling costs and limitations remain a major constraint.
F34	Use of specialist equipment	Booking systems available: could use multimedia to demonstrate use. Link of usage to LAS needed.
F35	Use of specialist accommodation	Booking systems available. Link of usage to LAS needed.
F36	Information skills training (part)	In-library could include practical exercises using library stock, and exception access to library staff.
F37	Delivery of inter-library loans (books)	End-user access not widely implemented for books because of security problems.
F38	Subject enquiries (part)	An important part of subject enquiry work is the 'negotiation' process which takes place between the user and the expert. Evidence to date shows this to be most effective when taking place in the Library, and self-service systems may need to be in-Library to be near this back-up.

### 5.3.2.3 Functions provided by special arrangement remotely

	<i>Function</i>	<i>Comments</i>
F39	Request items in stock and have them delivered.	Requires additional processes, most of which may require staff intervention in the absence of mechanical handling equipment.
F40	Return of items by post/courier	Straightforward for user, but in-library process as above.
F41	Delivery of inter-library loans (books)	Trivial if staff used to send books, but automated system would require mechanical handling.

### 5.3.3 Categorisation by System Requirements

A further analysis of the systems implementation requirements for the identified self-service functions reveals that each can be characterised by reference to seven fundamental attributes. These inform the systems designer of the complexity of inputs and data structures needed, whether the data is updated during the function, whether personal information (identifying an individual user) is required, whether the function is contained within the LAS or involves inter-system communications, whether physical objects have to be handled and whether payments are involved. The table below describes this categorisation in greater detail and shows the options used in subsequent tables in Section 5.4.

User Interaction	Non-interactive ↔ Simple ↔ Complex	Non-interactive operate through menus only. Simple interactive functions require the user to specify one or more keys (e.g. patron number; book number) which could be input from machine-readable labels. Complex interactive functions require the user to provide unstructured or semi-structured data, or to follow complex rules on data formats (e.g. title key words), and will require input from a keyboard or similar device.
Data Structure	Unstructured ↔ Simple ↔ Complex	Refers to the structure of data handled by the function. Unstructured data might be unformatted text added to a log file; simple structures relate to well-defined fields such as user numbers or ISBNs; Complex data might be bibliographic or formatted text. Note that these distinctions are crucial when considering networking and other standards.

Database Update	Static ↔ Dynamic	Static information is not capable of alteration during normal operation of a self-service function but requires staff intervention. Examples would be information about the Library or a MARC record referring to an item in stock. Dynamic information changes as a result of a normal self-service transaction. Examples would include loan records, inter-library loan requests and equipment booking records.
Personal information	Personal ↔ Non-personal	Personal functions are provided for users known to the system (with user number; PIN, etc.) and require that the user be identified uniquely. Non-personal functions apply to any user.
System	Intra-system ↔ Inter-system	Intra-system functions occur within the LAS. Inter-system functions require communication between the LAS and other systems.
Physical artefact	Physical ↔ Non-Physical	Physical functions require a physical object to be manipulated. Non-physical functions do not.
Payment	Payment ↔ Non-payment	Payment functions require the possibility of payment before the function is completed. Non-payment functions do not require a payment to be included.

The actual functional specification for each self-service function can be depicted by a matrix based on the above which establishes the principles on which the function should be based and helps to establish its relationship to other functions.

#### 5.3.4 Categorisation by Input Type(s)

The inputs to self-service library systems are of seven types - user identifier, user details, item identifier, item details, user specified data, selection code and function-specific inputs.

The *user identifier* may consist of an identifying number and a PIN.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
User identifier	Numeric	Varies with system - includes check digit
PIN	Numeric	Varies with system - may be preformatted (e.g. date of birth)

The *user details* consist of data which uniquely identifies the user, personal information, record privileges (related to system tables) and historical records.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
User identifier	Numeric	Varies with system - includes check digit
Name	Character	Varies with system
Address	Character	Number, Street, Town, Country, Postcode
Department	Varies	User specified
Function Privileges	Varies	Varies with system
Other	Varies	Varies with system

The *item identifier* consists of a unique identifying number which is attached to the item itself.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
Item identifier	Numeric	Varies with system - includes check digit

The *item details* can consist of a number of data elements. The data entered may be of varying completeness and correctness, except that the item identifier is deemed to be accurate. Generally the item details will be expected to follow bibliographic standards such as MARC. The outline below is a simplification. Note that simplified item details will be appropriate in many instances and that the data definition will depend on the function.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
Item identifier	Numeric	As <i>book number</i> above, but check digit may be omitted
Author	Character	Personal authors use "lastname, firstname" (XXXXX, XXXXX) format, but other formats will occur.
Title	Character	Free
ISBN	Numeric/ Character	NNNNNNNNNX Final character is check digit
Classification number	Numeric/ Character	Library defined depending on classification system used
Other fields	Varies	see MARC or similar specification

The user specified data consists of data input by the user in response to system prompts and may be simple or complex. In either case, the precise structure will be governed by the function and is not specified here.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
User specified data	Varies	Varies with function and system

The selection code is system specific and enables the user to identify a choice of function or sub-function.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
Selection code	Varies	Varies with system

There is also a category of specialised inputs related to particular functions. For example, if payment is required there needs to be an input of data that confirms that a sub-system

(ecash system, cashbox, etc.) has received the correct payment. These function-specific inputs are not defined here.

### 5.3.5 Categorisation by process modules

A further level of analysis of possible self-service functions and the way in which they might be constructed from a sub-functional viewpoint enables a table of functional modules to be constructed. These are the 'building blocks' for all functions: by selecting from this table, it is possible to construct a functional specification which can be applied to any self-service library systems - and which should accommodate future requirements. Interestingly (although this takes us beyond the scope of the SELF Project) this approach also provides a basis for the development of an integrated self-service workstation which might be designed around just such a portfolio of modules.

	<i>Module</i>	<i>Notes</i>
A	Selection from menu and validation of choice	Invalid leads to redisplay of menu with error message
B	Input & validation of user identifier	Invalid leads to limited recycling of input request, then revert to initial menu with error message
C	Retrieval of user details from LAS	User identifier acts as key
D	Validation of user privileges	Invalid leads to error message and revert to previous menu
E	Input & validation of bibliographic identifier	Validation level specified at design stage e.g. may include spell-check of title (note need for dictionary files and possible interaction with other system) but may also include override so that mis-spellings in published titles do not prevent retrieval. Some fields (e.g. classification number) can be format checked - refer to MARC specifications.
F	Input & validation of item identifier	Usually refers to book number or equivalent in local system. Invalid leads to re-input request (may be automatic) a limited number of times, then revert to previous menu.
G	Retrieval of item details from LAS	Item identifier acts as key
H	Input & validation of user specified data	Level of validation will be function specific and determined at design stage e.g. suggestions & complaints may be free text, or may be checked against stop words.
I	Retrieval & display of static information	Information defined by menu choice which controls retrieval from database(s) followed by display of retrieved data.

J	Retrieval & display of bibliographic or other complex data from LAS	May be a simple search (using a unique identifier) or a complex search (using search string) and may incorporate Boolean or other search strategies. Iteration may be required to enable the user to guide the results of complex searches.
K	Input & validation of function specific data	May be any data defined when the function implementation is designed
L	Retrieval & display of transaction data from LAS	Will normally use the item identifier as key to retrieve details of a previous transaction (e.g. a previous issue at return)
M	Retrieval & display of bibliographic data from remote system	See J. Note also the need for agreement on protocols (Z39.50, ERL, etc.)
N	Retrieval & display of other data from remote system	As M but protocols usually less well defined (Z39.70 etc. may be relevant)
O	Perform transaction within LAS	Update relevant fields in database to show that transaction has taken place.
P	Activate physical security of object	Physical object (book etc.) has security device activated to prevent removal from library.
Q	Deactivate physical security of object	Physical object (book etc.) has security device deactivated to enable removal from library through security system.
R	Recognise multiple objects	Applies to issue systems which deactivate security devices, and ensures that only objects which have been issued are desensitised
S	Time-out & disable user card	Applies to functions activated by user inserting a machine-readable card. To guard against stolen/unauthorised use, after a library-defined interval with no activity, card and item details flagged as disabled, with message to would-be user to report to staff.
T	Update user details on LAS	Update user details in respect of transaction which has just taken place.
U	Update item details on LAS	Update item details in respect of transaction which has just taken place.
V	Output to local file	Write data to file on local system
W	Output to remote system	Send data to file on remote system. Note requirement for suitable protocols
X	Receive payment	May be achieved by a variety of mechanisms including ecash systems
Y	Confirm completion of transaction to user	Display appropriate message to screen
Z	Special module	Defined separately by function

Note: The module specifications above do not include

- start up and close down sequences;
- statistical updating of logs for system management or management information purposes;
- error conditions and definitions, which will be developer and library specified, although it is assumed that exceptions will in appropriate cases terminate the process.

It should be assumed that all functions require such modules, and that they must be integrated with the LAS. More generally, the matter of integration of self-service functions with LAS functionality is a matter for systems developers to address: compatibility between the two is highly desirable.

## 5.4 Functional Requirements

### 5.4.1 Introduction

We generalise library functions by stating that the logical process consists of a unique user interacting with the library system and receiving a unique product, usually an information product. For self-service there is no intervention by library staff, unless exception conditions occur. The following is a brief summary of library self-service functions:

A library user is pre-identified to the library system and that user identifier provides the basis of authentication of the transaction.

The initial process may entail identifying the user uniquely through the user identifier, and where necessary retrieving details of the user, including authorisation status etc. (user details) from a Library Automation System. However, some functions are freely available to all library users without identification.

The process may involve the selection of a function by the user. In response to that selection the user may be offered information or requested to input data.

In the latter case, the next stage of the process involves *either* the provision of a (unique) item identifier by the user *or* the input of user-specified data, depending

on the function selected. This may again be in response to the provision of choices by the system

Where an item identifier is input, the next process is normally identification of the individual information item details as recorded within the Library's own database system based on the item identifier

Where user specified data is input, the process depends on the function selected.

Authentication of the transaction (as opposed to the user authentication) involves the application of a defined rule base.

Where removal of a physical artefact from the library is to be authorised, release of security restrictions occurs after authentication by the system and before information is presented to the user concerning the completion of the transaction.

The transaction may be rejected for any cogent reason at any of these stages.

Database details related to both the item and the user are then updated, as are statistical files, and the system is readied for the next transaction.

Exception conditions may need routing to library staff.

#### 5.4.2 Functional modules applied to self-service system processes

Based on the analysis and modularity defined in Chapter 3 above, each of the identified potential self-service functions can be defined functionally as shown on the following pages. For each of the 41 functions (F1-F41) identified above, we define three tables: Operational Function Categories, Data Inputs and Process Module Selection.

## F1 Selection of books and other materials for purchase by the Library

### *Operational Function Categories*

User Interaction	Complex	Requires the user to identify and confirm bibliographic details and to work with financial information
Data Structure	Complex	Bibliographic data
Database Update	Dynamic	Will result in new records on the database(s), update of financial data, and may update user details
Personal information	Personal	Authorisation for each user will have to be checked
System	Intra-system + Inter-system	Access to the LAS to check if items are already in stock and for financial data etc., followed by checking on 'books in print' databases and data transfer to a remote (bookseller) system.
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Details of book(s) required
Selection Code	Not required	
Function-Specific Data	Required	Financial data; Input from other systems (bibliographic; order confirmation)

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	Check that user has correct privileges
E	Input & validation of bibliographic identifier	User should be offered choice of input e.g. ISBN, Author+Title
J	Retrieval & display of bibliographic data from LAS	Check for matches in existing stock and display. Allow user to select item (e.g. place reservation). Allow ordering of extra copies if required.
M	Retrieval & display of bibliographic data from remote system	Check details against bibliographic database of books in print. Display matches, and allow selection.

Z	Check price details	Display price to user and ask for confirmation. Check within user authority level. Check within library-specified budget limit.
U	Update item details on LAS	Create 'on order' record and update budget commitments.
W	Output to remote system	Send order to supplier. (Note that at present not all libraries have teleordering capability, and that output to screen/print for library staff checking and action may be specified)
Y	Confirm completion of transaction to user	

## F2 Display of new books using imaging technology

### *Operational Function Categories*

User Interaction	Non-interactive	Could be simple or complex if selection option provided*
Data Structure	Complex	May require further complex data if selection option provided*
Database Update	Static	Access does not change database
Personal information	Non-personal	Unless user related (e.g. new books previously ordered by this user) - this could be an option*
System	Intra-system	Except if data held separately from LAS
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Not required	But see options above
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	But see options above
Selection Code	Not required	But see options above
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
I	Retrieval & display of static information	

\*Note: the above analysis assumes the simplest case where users select an option (perhaps from an OPAC screen) and are provided with a display of all new books added to stock since a given date. A more complex system could be provided which enabled users to select from categories (subject, date, etc.), or to view books they themselves have ordered. It might also be useful to link this system to F7 (Reservations).

### F3 Addition of electronic pages to the library's stock

#### *Operational Function Categories*

User Interaction	Complex	User specifies or creates the pages to be added, from local PC or from another system, and provides bibliographic data.
Data Structure	Complex	
Database Update	Dynamic	
Personal information	Personal	Authorisation will be required, and pages may be tagged to user (e.g. lecturer's name for an academic course)
System	Intra-system + Inter-system	Requires LAS to record details with pages stored either on LAS or on separate fileserver
Physical artefact	Non-Physical	
Payment	Non-Payment	

#### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Input of both bibliographic identifier and electronic page required
Selection Code	Not required	
Function-Specific Data	Not required	

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	Check that this user is permitted to add pages
H	Input & validation of user specified data	User inputs pages in appropriate format (e.g. might be page images in .PDF) and attaches bibliographic (or equivalent) data
U	Update item details on LAS	Create item record and add to indexes
W	Output to remote system	Store pages on appropriate system
Y	Confirm completion of transaction to user	

## F4 Catalogue enquiry

### *Operational Function Categories*

User Interaction	Complex	Requires user to input bibliographic data
Data Structure	Complex	Handling of bibliographic data within LAS and output to user
Database Update	Static	No changes made to database
Personal information	Non-personal	Usually: in limited circumstances parts of the function might be limited to authorised users
System	Intra-system	Could be inter-system if the enquiry spanned more than one catalogue (see, for example, the IRIS work in Ireland)
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Not required	
User Details	Not required	
Item Identifier	Not required	Except if item identifier key is provided (see optional module F below)
Item Details	Not required	
User Specified Data	Required	Bibliographic data to specify the search statement
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
E	Input & validation of bibliographic identifier	May be any appropriate identifier e.g. author + title, subject, ISBN.
(F)	(Input & validation of item identifier)	Option if retrieval by book number is offered
J	Retrieval & display of bibliographic or other complex data from LAS	
(M)	(Retrieval & display of bibliographic data from remote system )	(See above)
(L)	(Retrieval & display of transaction data from LAS)	(See note 1 below)
(V)	(Output to local file)	User requested option: for example to enable user to download records to a local file

- Notes
1. Most implementations also link the retrieved bibliographic details to item details so that loan status can be displayed to the user. Similarly there may be a link from 'on order' details to the items on order database to enable order date or expected delivery date to be displayed.
  2. It is desirable to provide a transparent link to related functions e.g. F7 so that a book which is identified may be reserved.

## F5 Join the Library

### *Operational Function Categories*

User Interaction	Complex	
Data Structure	Complex	
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	Possible inter-system for authentication
Physical artefact	Non-Physical	
Payment	Payment ↔ Non-Payment	Library defined

### *Data Inputs*

User Identifier	Not required	Supplied by system
User Details	Required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	May be used to select membership options
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
H	Input & validation of user specified data	Structured input of user details: validated against library-defined rules. Note security problem of authenticating input*
O	Perform transaction within LAS	Write details to database
(X)	(Receive payment)	If payment required
Y	Confirm completion of transaction to user	

\* Other sectors do not appear to permit self-service 'membership' unless the customer is already known to the system (e.g. a bank may accept an application for a credit card from an existing account holder). The question is whether to accept other 'proof of identity/status': would, say, a machine readable identity card or passport be regarded as adequate proof for accepting library membership? A partial solution would arise if libraries agreed to accept each other's library membership for this purpose. It is also possible that eligibility might be confirmed by accessing another system which had a suitable record available (assuming no data protection problems).

## F6 Overdue reminders

### *Operational Function Categories*

User Interaction	Simple	May not be required for an automatic alerting system
Data Structure	Complex	Look up bibliographic details
Database Update	Dynamic	Record that overdue notice has been sent
Personal information	Personal	
System	Intra-system	LAS function, but may need to access sub-system (e.g. email system) in some cases*
Physical artefact	Non-Physical	
Payment	Non-Payment	For this function, but could be coupled with F9

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	Unless user look-up on identifier is provided
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
G	Retrieval of item details from LAS	For overdue items only
L	Retrieval & display of transaction data from LAS	
J	Retrieval & display of bibliographic or other complex data from LAS	Retrieve bibliographic description of overdue item
(Z)	(Special module)	If output via different system required*
Y	Confirm completion of transaction to user	

Note: This function should include overdue interlibrary loans where that function has been implemented.

\* Some LAS systems have implemented non-display, non-print methods of notifying users of overdue items. Dynix, for example, has a module which automatically telephones a user and if necessary leaves a message on his/her answerphone. Other systems are able to transmit overdues by email.

## F7 Reservations

### *Operational Function Categories*

User Interaction	Complex	Bibliographical data needed to identify item
Data Structure	Complex	Bibliographical data
Database Update	Dynamic	See Appendix 1 for typical functionality required
Personal information	Personal	
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	Although some libraries do charge for this function

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	Option may be provided for 'last usable' date
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
E	Input & validation of bibliographic identifier	*
J	Retrieval & display of bibliographic or other complex data from LAS	*
B	Input & validation of user identifier	
(C)	(Retrieval of user details from LAS)	If library places limits on reservations by individual user or user type
O	Perform transaction within LAS	
U	Update item details on LAS	
(T)	(Update user details on LAS)	If library places limits on reservations by individual user
Y	Confirm completion of transaction to user	

\* May be obtained from Catalogue Enquiry (see F4)

## F8 Renewals

### *Operational Function Categories*

User Interaction	Simple	By user identifier or item identifier
Data Structure	Complex	Bibliographic data required to confirm transaction
Database Update	Dynamic	Record details in database
Personal information	Personal	
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	But user may select from displayed list
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	See above
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
F	Input & validation of item identifier	{Alternatives - if user defines item {directly
A	Selection from menu and validation of choice	{Alternatives - if items on loan {displayed to user
O	Perform transaction within LAS	
Y	Confirm completion of transaction to user	

## F9 Payment of fines and other charges

### *Operational Function Categories*

User Interaction	Complex	Will require user identifier and amount of payment as minimum, but likely to require confirmation also
Data Structure	Simple	
Database Update	Dynamic	
Personal information	Personal	Design could allow any user to pay fines
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Payment	

### *Data Inputs*

User Identifier	Required	As above
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Required	User will specify amount to be paid
Selection Code	Required	For payment method if a choice is given: required for ecash details.
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	* Data on fines would normally be tagged via the user details since the item may be returned and issued to another user before the fines are paid
G	Retrieval of item details from LAS	For items where fines have accrued
J	Retrieval & display of bibliographic or other complex data from LAS	For same items: displayed to user as confirmation
L	Retrieval & display of transaction data from LAS	Including relevant dates: displayed as confirmation to user
X	Receive payment	Systems vary*
T	Update user details on LAS	
Y	Confirm completion of transaction to user	May involve issue of printed receipt

\* See Deliverable Report 2b for a discussion of ecash etc. A coin/note operated system is marketed by ALS as part of its self-service issue system. For functional specification purposes such systems may be treated as a 'black box'.

## F10 Information on & amendment of personal records

### *Operational Function Categories*

User Interaction	Complex	Data on user (not required if data is for display [read only] purposes only)
Data Structure	Complex	
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	But links to other systems could become more common. In universities, for example, it is now usual to exchange data between library and student registration systems.
Physical artefact	Non-Physical	
Payment	Non-Payment	Option may be required by some libraries

### *Data Inputs*

User Identifier	Required	
User Details	Required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	
Selection Code	Not required	
Function-Specific Data	Not required	Possible payment system (see above)

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
H	Input & validation of user specified data	Related to specific user details e.g. address; telephone number; email address.
T	Update user details on LAS	
Y	Confirm completion of transaction to user	Display new record and confirm

## F11 Access to local databases

### *Operational Function Categories*

User Interaction	Complex	Requires some kind of (bibliographical or other) search key
Data Structure	Complex	Dependent on data base being searched
Database Update	Static	
Personal information	Non-personal	Some systems may require users to be identified, either for contractual reasons or to charge (in which case a payment method will be needed)
System	Inter-system	Although some local datasets could be held by the LAS
Physical artefact	Non-Physical	
Payment	Non-Payment	But see above

### *Data Inputs*

User Identifier	Not required	See above
User Details	Not required	See above
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Search statement
Selection Code	Required	To select between datasets and functions within
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
A	Selection from menu and validation of choice	To determine database(s) to be searched and search strategy*
H	Input & validation of user specified data	Search keys
N	Retrieval & display of other data from remote system	Depending on database type
M	Retrieval & display of bibliographic data from remote system	Depending on database type
(V)	(Output to local file)	May be provided as an option

\* Function should cycle to enable multiple searches, and should enable search results to be combined.

\*\* Link may be provided to library catalogue to determine availability of items retrieved from a bibliographical database.

## F12 Access to remote databases

### *Operational Function Categories*

User Interaction	Complex	Requires some kind of (bibliographical or other) search key
Data Structure	Complex	Dependent on data base being searched
Database Update	Static	
Personal information	Non-personal	Some systems may require users to be identified, either for contractual reasons or to charge (in which case a payment method will be needed)
System	Inter-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	But see above

### *Data Inputs*

User Identifier	Not required	See above
User Details	Not required	See above
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Search statement
Selection Code	Required	To select between datasets and functions within
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
A	Selection from menu and validation of choice	To determine database(s) to be searched and search strategy*
H	Input & validation of user specified data	Search keys
N	Retrieval & display of other data from remote system	Depending on database type
M	Retrieval & display of bibliographic data from remote system	Depending on database type
(V)	(Output to local file)	May be provided as an option

Note: the main difference between F11 and F12 will occur in the method of implementation. Ideally it should be transparent to the user whether the database is local or remote, and the functionality should be identical.

\* Function should cycle to enable multiple searches, and should enable search results to be combined.

\*\* Link may be provided to library catalogue to determine availability of items retrieved from a bibliographical database.

### F13 Bibliographies on demand

#### *Operational Function Categories*

User Interaction	Complex	Bibliographical or similar data (e.g. subject, date of publication range, and so on)
Data Structure	Complex	Bibliographical databases
Database Update	Static	
Personal information	Personal	For delivery to a particular user
System	Intra-system + Inter-system	Could be limited to local LAS e.g. for bibliographies of local library's stock holdings
Physical artefact	Non-Physical	
Payment	Non-Payment	But some libraries could charge

#### *Data Inputs*

User Identifier	Required	
User Details	Required	Search statement etc. to be attached to user details for repeat use
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Search strategy
Selection Code	Not required	
Function-Specific Data	Not required	

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
H	Input & validation of user specified data	As above
T	Update user details on LAS	Search statement attached to user details
J	Retrieval & display of bibliographic or other complex data from LAS	
(M)	(Retrieval & display of bibliographic data from remote system )	(If required)
V	Output to local file	i.e. for user: could be print or electronic
Y	Confirm completion of transaction to user	Bring attention of user to production of bibliography

## F14 Current awareness services

### *Operational Function Categories*

User Interaction	Complex	Bibliographical or similar data (e.g. subject, date of publication range, and so on)
Data Structure	Complex	Bibliographical databases
Database Update	Static	
Personal information	Personal	For delivery to a particular user
System	Intra-system + Inter-system	Could be limited to local LAS e.g. for regular listings of local library's stock holdings
Physical artefact	Non-Physical	
Payment	Non-Payment	But some libraries could charge

### *Data Inputs*

User Identifier	Required	
User Details	Required	Search statement etc. to be attached to user details
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Search strategy and frequency
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
H	Input & validation of user specified data	As above
T	Update user details on LAS	Record user profile(s)
	Above sets up user profile: following runs search (repeats)	
J	Retrieval & display of bibliographic or other complex data from LAS	At specified interval, using profile
(M)	(Retrieval & display of bibliographic data from remote system )	(If required)
V	Output to local file	i.e. for user: could be print or electronic
Y	Confirm completion of transaction to user	Bring attention of user to production of results

## F15 Booking of equipment for later use

### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Simple	Could be complex*
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	Possible linkage to other systems for additional functionality*
Physical artefact	Non-Physical	
Payment	Non-Payment	Payment might be built in e.g. for community group bookings

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	e.g. type of equipment required; time
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	
A	Selection from menu and validation of choice	From choice displayed by system*
H	Input & validation of user specified data	Any special requirements
O	Perform transaction within LAS	
Y	Confirm completion of transaction to user	

\* The function could be augmented by a multimedia presentation on the equipment, which would enable users to check that it offered the required functionality. This is not covered in this analysis.

## F16 Booking of Study Space for later use

### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Simple	Could be augmented by plan of spaces available*
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	Could be inter-system for augmented functionality*
Physical artefact	Non-Physical	
Payment	Non-Payment	Payment might be built in e.g. for community group bookings

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	e.g. type or size of room required; time; equipment
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	
A	Selection from menu and validation of choice	From choice displayed by system
H	Input & validation of user specified data	Including any special requirements
O	Perform transaction within LAS	
Y	Confirm completion of transaction to user	

## F17 Guide to library services

### *Operational Function Categories*

User Interaction	Non-interactive	
Data Structure	Complex	Could include multimedia sequences, plans, etc.
Database Update	Static	
Personal information	Non-personal	
System	Intra-system	Could access other local systems (e.g. information might be on a Web server)
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Not required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
A	Selection from menu and validation of choice	Note that 'menu' could be hypertext facility enabling user navigation around web or similar pages
I	Retrieval & display of static information	Could be text-based or could extend to multimedia information

## F18 Information skills training (in-Library or remote) (part)

See also F36

### *Operational Function Categories*

User Interaction	Complex	
Data Structure	Complex	Could include interactive multimedia
Database Update	Static	
Personal information	Personal	Not essential, but it may be felt desirable to keep a record of which users have received training*
System	Inter-system	May access packages held on other systems, or communication systems (e.g. email).
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	See above
User Details	Not required	See above
Item Identifier	Not required*	
Item Details	Not required	
User Specified Data	Required	Responses to system tuition; could involve group email for example
Selection Code	Required	To specify topic required etc.
Function-Specific Data	Required	Could, for example, be multimedia training materials

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
A	Selection from menu and validation of choice	
N	Retrieval & display of other data from remote system	From server holding training packages
W	Output to remote system	Interactive responses
(T)	(Update user details on LAS)	(When course completed)*

\* Option

## F19 Ordering of interlibrary loans

### *Operational Function Categories*

User Interaction	Complex	Bibliographical data to identify item required
Data Structure	Complex	Bibliographical database
Database Update	Dynamic	Record of requested items
Personal information	Personal	
System	Intra-system + Inter-system	Accesses remote library system(s)
Physical artefact	Non-Physical	
Payment	Payment + Non-Payment	Library option

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Bibliographic details and latest date of use
Selection Code	Required	e.g. may select libraries to try on basis of retrieved bibliographic records
Function-Specific Data	Required	Payment option

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	
H	Input & validation of user specified data	Details of item(s) requested
J	Retrieval & display of bibliographic or other complex data from LAS	Check that item not already in stock. If so provide reservation function (see F7)
(M)	(Retrieval & display of bibliographic data from remote system )	(If available, try remote library catalogues to identify item)
A	Selection from menu & validation of choice	Where options available to user for remote library; also for latest date of use
W	Output to remote system	Formulate and send request to remote system
T	Update user details on LAS	
O	Perform transaction within LAS	Local record of request
(X)	(Receive payment)	If required
Y	Confirm completion of transaction to user	

## F20 Delivery of interlibrary loans (photocopies - as page images)

### *Operational Function Categories*

User Interaction	Simple	Assuming item has been received (see F19 for ILL request)
Data Structure	Complex	Could be .PDF or other page image format
Database Update	Static	
Personal information	Personal	Delivery to requestor only
System	Inter-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	Assuming payment, if required, made with request

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	Select from items available for delivery to this user; select format
Function-Specific Data	Required	May require some kind of copyright declaration

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	Includes list of 'photocopies' received
A	Selection from menu and validation of choice	Select which to display
N	Retrieval & display of other data from remote system	From page server

## F21 Community Information

Similar to F17

### *Operational Function Categories*

User Interaction	Non-interactive	
Data Structure	Complex	May include text and multimedia elements
Database Update	Static	
Personal information	Non-personal	Community groups may be given 'private' files, in which case group identifiers will be needed.
System	Intra-system + Inter-system	Possibility of picking up data from other systems e.g. web pages on community groups
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Not required	But could be required by groups who are enabled to update their own information
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	e.g. to select between 'pages'
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
A	Selection from menu and validation of choice	
I	Retrieval & display of static information	

## F22 Operational information

See also F17

### *Operational Function Categories*

User Interaction	Non-interactive	
Data Structure	Complex	
Database Update	Static	
Personal information	Non-personal	
System	Intra-system + Inter-system	May link to other systems e.g. web pages
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Not required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
A	Selection from menu and validation of choice	
I	Retrieval & display of static information	May be multimedia

## F23 Complaints and suggestions

### *Operational Function Categories*

User Interaction	Complex	Unstructured text + possible category choices
Data Structure	Unstructured	
Database Update	Dynamic	Update file of inputs
Personal information	Personal OR Non-personal	System should allow users to be anonymous OR to provide user identification at their choice
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Optional	See above
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Text of complaint or suggestion
Selection Code	Not required	
Function-Specific Data	Optional	Could incorporate an interactive questionnaire, for example

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
H	Input & validation of user specified data	Text
(B)	(Input & validation of user identifier)	At users' choice
O	Perform transaction within LAS	Update file of inputs

## F24 Ability to review items already read

### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Complex	Bibliographic data
Database Update	Static	
Personal information	Personal	Must be limited to identified user
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Optional	Could include start date, for example

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
K	Input & validation of function specific data	Start date for display
C	Retrieval of user details from LAS*	
G	Retrieval of item details from LAS	
J	Retrieval & display of bibliographic or other complex data from LAS	For items previously borrowed
(V)	(Output to local file)	
Y	Confirm completion of transaction to user	

\* Most LAS do not keep an archive of all loan transactions because of the overhead: such an archive would however be essential to this function.

## F25 Ordering of electronic documents (without delivery)

### *Operational Function Categories*

User Interaction	Complex	Bibliographic identification
Data Structure	Complex	Bibliographic and full-text
Database Update	Static	
Personal information	Personal	Identifies the requestor to the system
System	Inter-system	
Physical artefact	Non-Physical	
Payment	Payment OR Non-Payment	Determined by library/supplier

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	To identify items required
Selection Code	Required	To select sources/options for delivery etc.
Function-Specific Data	(Required)	(Payment data)

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
A	Selection from menu and validation of choice	User selects service required from choice of data services
H	Input & validation of user specified data	Search statement
N	Retrieval & display of other data from remote system	Assumes list of available documents is on remote system
W	Output to remote system	Order sent to remote system (with delivery information e.g. fax number)
Y	Confirm completion of transaction to user	Confirmation to user
	Optional for restricted or payment systems:	
B	Input & validation of user identifier	Identify user
C	Retrieval of user details from LAS	Look up user record
D	Validation of user privileges	Check user has authorisation for this function
	as above, then	
X	Receive payment	Process payment (where required)

Note: this function exemplifies the type of system now available commercially, with separate delivery by non-telematic means (or, at best, by fax). See F26 for combined ordering/selection and delivery using telematics.

## F26 Delivery of electronic documents (includes order/selection phase)

### Operational Function Categories

User Interaction	Complex	Bibliographic identification
Data Structure	Complex	Bibliographic and full-text
Database Update	Static	
Personal information	Personal	Identifies the user to the system: some systems may not require this if document delivery is open to all users
System	Intra-system + Inter-system	
Physical artefact	Non-Physical	
Payment	Payment	Optional to library/supplier

### Data Inputs

User Identifier	Not required	See above
User Details	Not required	See above
Item Identifier	Not required	Unless 'items' are regarded as part of library 'stock'
Item Details	Not required	As above
User Specified Data	Required	
Selection Code	Not required	
Function-Specific Data	Not required	Required if payment is required

### Process Module Selection

Module	Description	Comments
A	Selection from menu and validation of choice	User selects service required from choice of data services
H	Input & validation of user specified data	Bibliographic or other selection statements
N	Retrieval & display of other data from remote system	Retrieves bibliographic/order data from remote system in response to search selection
A	Selection from menu and validation of choice	Or equivalent. Enables user to select item to be delivered and choose format etc.
V	Output to local file	Delivery to user's workstation or local filestore
Y	Confirm completion of transaction to user	
	Optional for restricted or payment systems:	
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	Check user is authorised for this type of transaction
	as above, then	
X	Receive payment	Process payment (where required)

Note: systems including electronic delivery are limited largely by copyright/contractual considerations but are becoming available. A major challenge is to integrate this functionality with other library functions e.g. OPAC.

## F27 Ordering from Closed Stacks

### *Operational Function Categories*

User Interaction	Complex	User specification based on catalogue search (see F4)
Data Structure	Complex	Bibliographic and location data
Database Update	Dynamic	Record of item status; date/time of requirement
Personal information	Personal	Identify user
System	Intra-system	
Physical artefact	Non-Physical	Assuming that staff intervene to identify item from shelves and deliver to pick-up point. Fully automated mechanical handling system is theoretically possible.
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	Assume catalogue access is used to identify the title required
Selection Code	Not required	
Function-Specific Data	Required	Could be used to enable user to specify a date/time that the item is to be available

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
E	Input & validation of item identifier	
G	Retrieval of item details from LAS	Check item is available
K	Input & validation of function specific data	Date & time item is to be ready for collection
U	Update item details on LAS	Show item as booked to prevent further issue
Y	Confirm completion of transaction to user	

## F28 Subject enquiries (part)

### Operational Function Categories

User Interaction	Complex	Free format or preformatted (e.g. in response to interactive forms)
Data Structure	Unstructured	May use FAQ or similar files as additional resource
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	

### Data Inputs

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Text of enquiry
Selection Code	Required	Source to use for answer
Function-Specific Data	Required	Enquiry related database e.g. FAQ file

### Process Module Selection

Module	Description	Comments
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
(D)	(Validation of user privileges)	(If use of the facility is restricted)
A	Selection from menu and validation of choice	Select source to be used for enquiry (e.g. FAQ file; specialist staff)
H	Input & validation of user specified data	Specify the enquiry
(J)	(Retrieval & display of bibliographic or other complex data from LAS )	(e.g. from FAQ file)
Z	Special module	Output query to subject specialist (e.g. by email) for attention and reply
	Following response from specialist (if using a database rather than email approach):	
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
J	Retrieval & display of bibliographic or other complex data from LAS	Note user identifier must be used as key to prevent others accessing reply
Y	Confirm completion of transaction to user	Possible to recycle query back from here is user not fully satisfied

## F29 Open Access to Stock\*

\* This function is included here for completeness. It does not rely on telematic systems for the fundamental function of users having access to browse among shelves. However, some libraries operate on an unstaffed basis with access control via an electronically controlled access door. Where that access is linked to the LAS (to check user privileges before allowing access) the analysis below would apply.

### *Operational Function Categories*

User Interaction	Simple	Identifier only
Data Structure	Simple	Look up of user details to determine authorisation status
Database Update	Dynamic	To record entry
Personal information	Personal	
System	Intra-system + Inter-system	Linkage between security access system and LAS
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	
Z	Special module	LAS authorises access to access control system
T	Update user details on LAS	Record date/time access granted**

\*\* Note that it is possible to check user identifiers at the exit also and record the date/time the user left the library.

### F30 Ordering from closed stacks\*

#### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Complex	
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	
Physical artefact	Non-Physical	Assuming that staff intervene to identify item from shelves and deliver to pick-up point. Fully automated mechanical handling system is theoretically possible.
Payment	Non-Payment	

#### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	Assume Catalogue access is used to identify the title required
Selection Code	Not required	
Function-Specific Data	Not required	

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
E	Input & validation of item identifier	From Catalogue Enquiry (see F4)
G	Retrieval of item details from LAS	Check item is available
K	Input & validation of function specific data	Date & time item is to be ready for collection
U	Update item details on LAS	Show item as booked to prevent further issue
Y	Confirm completion of transaction to user	

\*See F27 for function defined for use from outside the Library: the above analysis applies to ordering as an additional catalogue access function within the Library with immediate delivery. Again, mechanical handling systems are assumed not to be appropriate.

## F31 Issue of books and other materials

### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Complex	Includes bibliographical details
Database Update	Dynamic	Updating of both item and user details required
Personal information	Personal	
System	Intra-system + Inter-system	
Physical artefact	Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	Check that user is permitted to borrow books and does not have 'blocks': these will be library specified
R	Recognise multiple objects	Invalid if more than one, unless system can identify each item identifier
F	Input & validation of item identifier	
G	Retrieval of item details from LAS	Various validity checks: item is 'issuable'; not already on loan; etc.
J	Retrieval & display of bibliographic or other complex data from LAS	May be displayed to user to confirm identity of item
O	Perform transaction within LAS	Record the transaction with date/time
T	Update user details on LAS	
U	Update item details on LAS	
Q	Deactivate physical security of object	Release security tag to enable item to be taken out of the library
Y	Confirm completion of transaction to user	Repeat from 'R' if further loans required: print receipt after each or after all completed
S	Time-out and disable user card	If a user card is left in place with no further action for a period greater than defined (library definition)

## F32 Book and other materials returns

### *Operational Function Categories*

User Interaction	Non-interactive or Simple	Action of placing an item in a 'return' receptacle may be sufficient
Data Structure	Simple	
Database Update	Dynamic	Updating of loan records
Personal information	Personal	
System	Intra-system	
Physical artefact	Physical	
Payment	Non-Payment	Could be linked to payment of fines (see F9)

### *Data Inputs*

User Identifier	Not required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
F	Input & validation of item identifier	Input directly from item; may not require user intervention
G	Retrieval of item details from LAS	
L	Retrieval & display of transaction data from LAS	May be omitted if user confirmation of return not required
O	Perform transaction within LAS	
P	Activate physical security of object	Activation prevents item being removed from the library
T	Update user details on LAS	
U	Update item details on LAS	
Y	Confirm completion of transaction to user	May be omitted (see above)

Note: the above analysis is based on current security technology used in libraries. In some future scenarios (e.g. use of active badges) a different specification would be required since no switching would be necessary.

### F33 Automatic sorting and reshelving of books

#### *Operational Function Categories*

User Interaction	Non-Interactive or Simple	
Data Structure	Simple	
Database Update	Dynamic	Assuming LAS will record location of books
Personal information	Non-personal	
System	Intra-system	
Physical artefact	Physical	
Payment	Non-Payment	

#### *Data Inputs*

User Identifier	Not required	
User Details	Not required	
Item Identifier	Required	As above
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
F	Input & validation of item identifier	Automatically identify item
G	Retrieval of item details from LAS	
J	Retrieval & display of bibliographic or other complex data from LAS	To determine shelf location
O	Perform transaction within LAS	Record location of item
Z	Special module	Transport item to shelf and shelve

Note: this function is assumed to be an add-on to F32

### F34 Use of specialist equipment

#### *Operational Function Categories*

User Interaction	Simple or Complex	Depending on information on equipment which is available
Data Structure	Simple or Complex	Depending on information on equipment which is available
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system + Inter-system	Linkage between security access system and LAS
Physical artefact	Non-Physical	
Payment	Non-Payment	

#### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Required	If information on the equipment is to be made available to users as part of the function

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	
I	Retrieval & display of static information	To show the equipment to users: could be multimedia package
Z	Special module	LAS authorises access to access control system
T	Update user details on LAS	Record date/time access granted**

\*\* Note that it is possible to check user identifiers as users exit also and record the date/time the user left the facility.

Note: see F15 for booking for later use. This function assumes limited access to the equipment, controlled by checking (automatically) user identifiers and checking access privileges.

## F35 Use of specialist accommodation

### *Operational Function Categories*

User Interaction	Simple or Complex	Depending on information on accommodation which is available
Data Structure	Simple or Complex	Depending on information on accommodation which is available
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system + Inter-system	Linkage between security access system and LAS
Physical artefact	Non-Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	
I	Retrieval & display of static information	To show the equipment to users: could be multimedia package
Z	Special module	LAS authorises access to access control system
T	Update user details on LAS	Record date/time access granted**

\*\* Note that it is possible to check user identifiers as users exit also and record the date/time the user left the facility.

Note: see F16 for booking of accommodation for later use. This function assumes limited access to the equipment, controlled by checking (automatically) user identifiers and checking access privileges.

### F36 Information skills training (in-library) (part)\*

#### *Operational Function Categories*

User Interaction	Complex	
Data Structure	Complex	
Database Update	Static	
Personal information	Personal	Not essential, but it may be felt desirable to keep a record of which users have received training
System	Inter-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	

#### *Data Inputs*

User Identifier	Required	See above
User Details	Not required	See above
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Responses to system tuition; could involve group email for example
Selection Code	Required	To specify topic required etc.
Function-Specific Data	Required	Could, for example, be multimedia training materials

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
A	Selection from menu and validation of choice	
N	Retrieval & display of other data from remote system	From server holding training packages
Z	Special module	Reference to specialist tutors when required
(T)	(Update user details on LAS)	(When course completed)

\* Note that this function is identical to F18, with the exception of reference to specialist tutors.

### F37 Delivery of inter-library loans (books)

#### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Simple	
Database Update	Dynamic	Record date/time collected
Personal information	Personal	
System	Intra-system	
Physical artefact	Physical	Equipment needed to deliver book only to correct user (possibly 'reverse BTJ Returns system'?)
Payment	Non-Payment	Assume payment made when item ordered

#### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
J	Retrieval & display of bibliographic or other complex data from LAS	Lists ILL books available for collection
A	Selection from menu and validation of choice	User selects book to be collected
Z	Special module	Book delivered to user

### F38 Subject enquiries (in-library) (part)

#### *Operational Function Categories*

User Interaction	Complex	
Data Structure	Unstructured	
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	
Physical artefact	Non-Physical	
Payment	Non-Payment	

#### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Not required	
Item Details	Not required	
User Specified Data	Required	Text of enquiry
Selection Code	Required	Source to use for answer
Function-Specific Data	Required	Enquiry related database

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
(D)	(Validation of user privileges)	(If use of the facility is restricted)
A	Selection from menu and validation of choice	Select source to be used for enquiry (e.g. FAQ file; specialist staff)
H	Input & validation of user specified data	Specify the enquiry
(J)	(Retrieval & display of bibliographic or other complex data from LAS )	(e.g. from FAQ file)
Z	Special module	Reference to subject specialist staff when required

\* Note that this function is similar to F28, except that reference to subject specialist staff is assumed.

### F39 Request items in stock and have them delivered

#### *Operational Function Categories*

User Interaction	Complex	Similar to catalogue access
Data Structure	Complex	Bibliographic and addressing data
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	
Physical artefact	Physical	
Payment	Non-Payment	Some libraries may wish to charge for such a service

#### *Data Inputs*

User Identifier	Required	
User Details	Required	If delivery address needs to be given (option)
Item Identifier	Required	
Item Details	Required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

#### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
D	Validation of user privileges	Function may be restricted e.g. in an academic library to off-campus users
E	Input & validation of bibliographic identifier	
J	Retrieval & display of bibliographic or other complex data from LAS	To confirm selection
Z	Special module	Message to library staff to select book + address label and package item for despatch*
O	Perform transaction within LAS	
T	Update user details on LAS	With delivery address if required (see above)
U	Update item details on LAS	
Y	Confirm completion of transaction to user	

\* Assumes that a mechanical handling system for parcelling and despatch is not available.

## F40 Return of items by post/courier

### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Simple	
Database Update	Dynamic	
Personal information	Personal	
System	Intra-system	
Physical artefact	Physical	
Payment	Non-Payment	

### *Data Inputs*

User Identifier	Not required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
F	Input & validation of item identifier	
G	Retrieval of item details from LAS	
L	Retrieval & display of transaction data from LAS	
O	Perform transaction within LAS	
T	Update user details on LAS	
U	Update item details on LAS	
(Z)	(Special module)	(Information transmitted to user that fine is owing or other exception condition)
Y	Confirm completion of transaction to user	

This function is similar to F32, except that an additional module is included to transmit information to the user on exception conditions. It could be found that this additional step was useful in F32 also, instead of direct communication to the user within the library (which is suggested there as an option).

## F41 Delivery of inter-library loans (books)

### *Operational Function Categories*

User Interaction	Simple	
Data Structure	Simple	
Database Update	Dynamic	Record date/time collected
Personal information	Personal	
System	Intra-system	
Physical artefact	Non-Physical	Physical despatch of books requires later staff intervention
Payment	Non-Payment	Assume payment made when item ordered

### *Data Inputs*

User Identifier	Required	
User Details	Not required	
Item Identifier	Required	
Item Details	Not required	
User Specified Data	Not required	
Selection Code	Not required	
Function-Specific Data	Not required	

### *Process Module Selection*

<i>Module</i>	<i>Description</i>	<i>Comments</i>
B	Input & validation of user identifier	
C	Retrieval of user details from LAS	
J	Retrieval & display of bibliographic or other complex data from LAS	Lists ILL books available for collection/delivery
A	Selection from menu and validation of choice	User selects book to be delivered
Z	Special module	Instruction to library staff to despatch book

- Notes: 1. It is assumed that mechanical handling and despatching equipment is not an option.  
 2. It is further assumed that despatch direct from the lending library to the borrower is not available (F39 would be appropriate in this case).

#### 5.4.3 User Interfaces

In a normal functional specification a user interface can be specified in detail. However the SELF project will not result in an actual developed application and thus the user interface cannot be specified in detail. Reference should be made to Deliverable Report 2b for a discussion of the principles involved within the context of Open Systems.

#### 5.4.4 External and Systems Interfaces

As noted above self-service systems may be integrated parts of LAS or may be standalone systems which interact with the LAS across networks (whether LANs or wider area networks). Furthermore self-service systems may consist of separate hardware/software components which require to communicate internally with one another. At present there are no agreed standards specifically for self-service systems interactions as such, although it is noted - to give one example - that where the exchange of bibliographic data is involved the Z39.50/SR standard is available. (For further information on these issues readers are referred to Deliverable Report 2b.)

## 6 Self-Service Applications

In this section we provide two examples of functional specifications for a self-service system, based on our earlier analyses. The examples chosen concern the development of an interlibrary loans request service (F19 from Chapter 5), which could be accessed by users in the library or by those accessing the library's services remotely, and the development of an issue system (F31).

### 6.1 Inter-Library Loans

#### 6.1.1 Introduction

An inter-library loan is a loan of an item from one institution to another for the purposes of satisfying a borrower request which cannot be satisfied by the home library's stock. At the request stage details of the required item are received from the borrower, it is verified that the borrower is currently entitled to place an ILL request, the bibliographic details are validated and verified to ensure that they refer to an existing item and it is checked that the item is not available in the home library. The request is then either rejected for cogent reasons or the validated bibliographic details with extra details, such as the home library reference and address, are passed to libraries and systems external to the home library. These external systems may be of a variety of types including a range of automated and clerical systems.

This function is compatible with self-service implementation. The processes of validation and verification of details which are normally carried out by a professional librarian complicate matters however. The generalised specification given in Chapter 5, F19 (page 63), is used as the basis for the description which follows.

#### 6.1.2 Operational Function Categories

It is noted that an interlibrary loan request system will incorporate the following general systems requirements:

- interaction with the user will make use of complex data structures, principally to enable the required item to be identified from suitable bibliographic data;
- the data structures used internally by the system will also be complex, again including bibliographic data;
- there will be a requirement for write access to the LAS database i.e. the database should be regarded as dynamic;

- personal information about the user will be required, including access to the user details;
- there will be both intra-system (i.e. within the LAS) and inter-system (e.g. to a remote library's LAS) subfunctions;
- handling of physical artefacts (e.g. books) will not be required;
- payment by the user may or may not be required, at the option of the library.

### 6.1.3 Inputs

The following inputs will be needed:

#### 6.1.3.1 User Identifier

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
ID Number	Numeric	Varies with system, and may include check digit
PIN	Numeric	Varies with system

#### 6.1.3.2 User Specified Data

Two types of user specified data may be used:

##### 6.1.3.2.1

The bibliographic details are mandatory. They can consist of one or more of the following data elements.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
Author	Character	XXXXX, XXXX (Lastname, Firstname)
Title	Character	Free
ISBN	Numeric/ Character	NNNNNNNNNX Final char is check digit.
etc.	...	...

The data entered may be of varying completeness and correctness, but the library will specify a rule-base for acceptability. The following table gives an example:

<i>Data Element</i>	<i>Rule</i>
Author/Editor	Mandatory in format 'Lastname, Firstname' or corporate body. User should be able to override by confirming that there is no author or author is unknown. Include indicator for editor.
Title	Mandatory in free format: can be spell-checked but with user override facility
Publisher	Not mandatory
Date of publication	Mandatory in nnnn format
Edition	Optional; in numeric format
ISBN	Spaces and hyphens allowed
Journal title	Mandatory for journal requests only (author and title above refer to paper)
Issue details	Mandatory for journal requests only; via form prompts for volume, issue and page numbers
Other	Free format field for any information (e.g. source of reference) which may be useful if manual intervention is required

#### 6.1.3.2.2

The user should be able to specify the latest date on which the item will still be of use.

#### 6.1.3.3

A selection code should be used to allow the user to specify which remote libraries should be approached for the loan.

#### 6.1.3.4

A payment may be required. The payment system itself is outside the scope of this description but input of a verified amount paid will be needed for this system.

#### 6.1.4 Processing

Notes: 1. Number of iterations on detection of exception conditions will be specified at implementation.

2. Allow user to abandon request process at any time.

##### 6.1.4.1 Input & Validation of User Details

Validate format and check digit of ID number if applicable.

Validate format and check digit of PIN if applicable.

Request re-input (x times) if invalid.

##### 6.1.4.2 Retrieval of user details from LAS

Retrieve user record using validated input.

If record does not exist request re-input of details (x times).

##### 6.1.4.3 Validation of User Privileges

Check user privileges to ensure that user is entitled to place ILL request and privilege level.

If not so entitled (e.g. nonprivileged borrower or a borrower who has reached ILL request limit) then reject request with message indicating reason.

##### 6.1.4.4 Input & Validation of User Specified Data

Input data to identify item requested (see 5.3.2.1 for rule base)

Check ISBN against appropriate check digit algorithm. Ask for re-input if incorrect.

##### 6.1.4.5 Retrieval & Display of bibliographic or other complex data from LAS

Check verified details against home library catalogue.

If item is in the home library and satisfies certain criteria, e.g. it is a loanable item and is not on long-term loan, then indicate that item may be borrowed or placed on hold (reserve) as appropriate and provide optional branch to appropriate function.

6.1.4.6 Retrieval & Display of bibliographic data from remote system(s)

Determine remote system(s) to search by reference to user privilege and library priority list

Check details against selected databases.

If details cannot be linked to real item then reject request indicating reasons to user.

If details can be linked to one or more records then display these to user.

6.1.4.7 Selection from menu & validation of choice

Input user selection of item required

6.1.4.8 Output to remote system

Compose ILL request message from bibliographic details, user identifiers and library identifiers and 'last date required'.

Send message to remote system & confirm

6.1.4.9 Update user details on LAS

Tag details of request to user details

6.1.4.10 Perform transaction within LAS

Create local record of request

6.1.4.11 Receive payment

Record receipt of payment from sub-system

6.1.4.12 Confirm completion of transaction to user

Display 'transaction completed' message to user

### 6.1.5 Outputs

The output will be the completed ILL request message. The following data elements may be included.

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
ISBN	Numeric/Character	NNNNNNNNNX
AUTHOR	Character	MARC standard
TITLE	Character	MARC standard
etc.		
LIBRARY-ID	?	?
USER-ID	Numeric	Varies with System

The user privilege determines to what external institutions this ILL request may be sent.

### 6.1.5 Other Requirements

#### 6.1.5.1 Data Base

The following data elements will need to be added to the user database.

ILL Allowed	Y/N
ILL privilege level	NNN (numeric)
Number of ILL requests allowed	NNN
Number of requested used	NNN

An external ILL institution database will need to be set up. At least the following data elements will be required.

Institution Name	Text
Privilege Level Required	NNN (Numeric)
Address	System dependent

A user whose privilege level falls below the privilege level required for a particular institution will have no requests sent to that institution. This will allow the priority levels of

users of different types to be discriminated. For example undergraduates may have their requests sent to other libraries in Ireland but only research students and above are allowed generate requests to the more expensive BLDSC.

#### 6.1.5.2 Site Adaptation

Actions to be taken by each site in setting up this function include

- “ Set up of external ILL institution database.
- “ Modification of user database.
- “ Application of privilege level parameters etc..

#### 6.1.5.3 Copyright

The specification assumes that copyright clearance can be handled by the library operational procedures. Developers need to be aware, however, that copyright law may prevent fully self-service operation where a photocopy is requested since a personal signature may be required. However, some libraries have been able to manage this process by holding back supplied photocopies against a signature rather than allowing direct delivery. The problem would not apply where a book loan was being requested.

## 6.2 Issues

### 6.2.1 Introduction: A Self-Service Application: Issue of books and other materials

In this section we provide an example of a functional specification for self-service issuing with a Self-Service Issue System (SSIS), based on our earlier analyses. The example chosen concerns the issuing of books and/or other materials (F31 from Chapter 5, page 63).

This example will be limited to a common situation in the library world. The user is physically visiting the library. The books and other materials that he wants to borrow and bring with him outside the library walls are all placed on open shelves. Ordering from closed stacks (F27 and F30) will not be covered in this example. In the future it will of course become more common that the material the user wants to bring with him is stored electronically and will be transferred to the user's laptop or its future successor. In this example we will though limit ourselves to physical materials. The user may use several functions described in Chapter 5 to find requested materials, e.g. F2 (Display of new books using imaging technology), F11 and F12 (Access to local and remote databases), F13 (Bibliographies on demand) and F14 (Current

awareness services). Still one of the most commonly used methods is probably that the user knows where the books in his subject fields are situated and simply goes to the shelves and picks up the books he finds interesting. A second common method is to use the OPAC, F4 (Catalogue enquiry) where he could search on bibliographic data or on subject. An interesting self-service function OLGA, developed by the Swedish system supplier Axiell, could be mentioned here. After the user has found a requested book a window pops up with a map over the library and a graphical character guides the user from the OPAC to the shelf where the book in question is placed.

This example will not cover the different ways the user could find the books described above but merely the stage afterwards when the user wants to issue the requested items. The data required here are the *user details* and the *user identifier*, today commonly a barcode, which might be combined with a PIN code for additional security. Finally the system will use the *item details* held by the system and an *item identifier* attached to the item itself. We assume that the library uses self-service issuing and a theft alarm system, which means that the theft alarm attached to each item has to be deactivated. The theft alarm system makes the process a little bit more complicated but most of the procedure is the same as if no theft alarm system is used. The procedure would essentially also be the same if it were carried out by staff instead of the user himself. No payment will be required for the loans.

### 6.2.2 Operational Function Categories

The issue of books and other materials will incorporate the following general systems requirements:

- interaction with the user will make use of simple data structures, patron number and item number to identify the user and the item, and a number of flags and other information about item loan type, user privileges etc., which rules different messages and gives information about if the user is entitled to borrow a certain item;
- the data structures used internally by the system will also be simple;
- the database should be regarded as dynamic, there will be a need to update the user and item details for every transaction with information as changed status of the item, due date etc.;

- personal information about the user will be required, including access to the user details;
- there will be intra-system (i.e. within the LAS) functions and if the SSIS is not a part of the LAS there will also occur inter-system functions and communication between the LAS and the SSIS;
- handling of physical artefacts (e.g. books) will be required;
- payment by the user may or may not be required, at the option of the library.

### 6.2.3 Inputs

The following inputs will be needed:

#### 6.2.3.1 User Identifier

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
ID Number	Numeric	Varies with system, and may include check digit
PIN	Numeric	Varies with system

In this example it will be a borrower card with a barcode and a PIN, which normally consists of four digit.

### 6.2.3.2 User Details

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
User identifier	Numeric	Varies with system - includes check digit
Name	Character	Varies with system
Address	Character	Number, Street, Town, Country, Postcode
Department	Varies	User specified
Function Privileges	Varies	Varies with system
Other	Varies	Varies with system

The *user details* consist of data, held by the system, which uniquely identifies the user, personal information, record privileges (related to system tables) and historical records. The elements used in the issue process are User identifier, Function privileges and Other.

### 6.2.3.3 Item Identifier

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
Item identifier	Numeric	Varies with system - includes check digit

The *item identifier* in this example will be a unique barcode attached to the item.

#### 6.2.3.4 Item Details

<i>Data Element</i>	<i>Type</i>	<i>Format</i>
Item identifier	Numeric	As <i>book number</i> above, but check digit may be omitted
Author	Character	Personal authors use a surname, first name@ (XXXXX, XXXXX) format, but other formats will occur.
Title	Character	Free
ISBN	Numeric/ Character	NNNNNNNNNX Final character is check digit
Classification number	Numeric/ Character	Library defined depending on classification system used
Other fields	Varies	see MARC or similar specification

The *item details* consist of a number of data elements. The ones that will be used in the example are the *Item Identifier* and *Item Loan Type*.

#### 6.2.4 Processing

Notes:

1. Number of iterations on detection of exception conditions will be specified at implementation.
2. Allow user to abandon request process at any time.

##### 6.2.4.1 Input & Validation of User Details

The user is asked to identify himself by the Self-Service Issue System (SSIS).

The user puts his borrower card in a slot or somewhere where the SSIS can read it.

The SSIS validates format and checks digit of the ID number or asks the Library Automation System (LAS) to do it.

The user is asked to enter his PIN code.

The user enters his PIN code.

The SSIS validates format and checks digit of PIN or asks the LAS to do it.

If the ID number or the PIN is invalid the user is requested (x times) to re-enter it or to contact library staff.

#### 6.2.4.2 Retrieval of user details from LAS

The user record is retrieved using the validated input.

If the record does not exist request re-input of details (x times).

#### 6.2.4.3 General user messages

If the user record holds a flag for some kind of messages it is displayed.

It could be a message that the user is not allowed to perform an issue due to some reason and is therefore requested to contact library staff. There could be flags for things like too many outstanding loans or payments of fines etc.

It could also be messages, which do not stop the process but inform the user that an ILL or a requested book has arrived.

#### 6.2.4.4 Input & Validation of Item identifier

If there is no general message the user is asked to put the item so that the SSIS can identify it.

The SSIS validates format and checks digit of the item identifier or asks the Library Automation System (LAS) to do it.

If no item can be identified by the system within a certain time span (x seconds) the user is asked to remove his borrower card.

#### 6.2.4.5 Validation of User Privileges

For each item that the user wants to issue, the loan type of the item is checked and compared with the user privilege level to ensure that the user is entitled to issue the item.

If not so entitled (e.g. for a reference item) then reject request with a message indicating reason.

#### 6.2.4.6 Update user details on LAS

The user details are updated with information about every item issued.

#### 6.2.4.7 Deactivate theft alarm

The theft alarm is deactivated for every item issued.

#### 6.2.4.8 Confirm transaction to user

After each item issued a message is displayed informing the user that the transaction of the item has been successful and that he could continue with the next item or stop the process by removing the borrower card or by another way

#### 6.2.4.9 Finalise process

When the user has stopped the process by removing the borrower card or by some other way a notice is printed telling the user which items have been borrowed, the due back dates and other optional information.

#### 6.2.4.10 Input & Validation of User Details

The SSIS returns back to stand by status and asks the user to identify himself.



## 7 The Shortcomings of Present Self-Service Library Systems

### 7.1 Introduction

During the Project the team analysed the library self-service systems market in general and examined a number of specific systems in particular. In this Chapter we highlight what we see as the major current deficiencies of existing systems. It is hoped that this analysis will provide pointers for future development.

### 7.2 Open Systems and Self-Service

Although Z39.50 is one of the standards that has been most successful in bringing interoperability to Library Automation Systems, it has been used more by librarians to access other library systems than by products designed for use by the general public. This is because in the case of OPAC there are two crucial elements for full public use. Firstly a public searcher will nearly always require the ability to check the status of items in the library whose catalogue is being searched . Secondly they will also want to be able place holds on items which are currently on loan from that library. Version 2 of Z39.50, which is the latest implemented by most Library Automation Systems (if they use it at all), handles neither of these requirements. Version 3 will allow the status of items to be viewed but defines no way by which a hold can be placed. Hence for most members of the public using a standard OPAC session to each library that they use makes the most sense. This is despite the fact that they may have to learn a different interface for each.

It should also be noted that it could be argued that this is an area in which Z39.50 ought not to define standards. This is so because it is defined as an 'Information Retrieval Protocol' which specifies only how a requesting computer may '1) request that the target search a database and identify records which meet specified criteria, and 2) request transmission of, and receive, some or all of the identified records.'<sup>2</sup> However the Project team are of the view that the development of a standard should not be constrained by the original scope defined for the standard and that this area merits examination. As Z39.50 is currently the best way in which a range of library automated systems can be accessed in a standard way then there is every reason that it should be extended to take account of other requirements, such as the placing of reservations, which fall beyond its original intent.

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<sup>2</sup> ANSI/NISO, 1992, p. iii

For the present the open systems standards which have aided the development of OPAC access are at a lower level than Z39.50 and do not provide the basis for a common interface or choice of interface when accessing library systems. These standards would include.

- The ITU-TSS (International Telecommunications Union-Telecommunications Standards Section) V series, including V.22, V.22bis, V.32 etc., which define modulation, error correction and compression techniques for communications over standard PSTN lines. These have been essential in allowing remote access to OPAC services.
- IPS, the Internet Protocol Suite, in its role as the foundation for the Internet has provided access to OPACs world-wide without the user incurring the cost that a direct dialup would involve using the telnet application instead.

Self service access to community/campus information is an option which some Library Automated Systems provide. However there is no standardisation of record structure or communications format in this area. Nor have search attribute sets been defined.

The situation is similar with access to patron information. However some work was done in trying to provide standards in this area under the guise of Z39.70.

It is the view of the SELF Project team that both of these areas would benefit from standardisation. Both could be dealt with as newly defined attribute sets under Z39.50. All that would be required is that a common set of fields for search and retrieval purposes be identified.

One important issue that should be noted is that SR unlike Z39.50 does not support Access Control. If Z39.50/SR protocols were used to search and return user personal information then it would be necessary to be using a client and server with compliance going beyond the current level of SR. Access control would be necessary to ensure that unauthorised persons did not gain access to user details stored on the system.

### 7.3 Open Systems and Self Service Issue and Return

Self-service issue and return provide yet more complicated functionality in comparison with the simple information access functions described above. This is for the following reasons

## 1. Security

- The requirement to reliably identify the item being borrowed or returned.
- The requirement to reliably identify the person borrowing an item.
- The requirement to desensitise the item being borrowed and only that item.

## 2. The variety of peripheral devices

- Barcode readers for item barcodes and/or user cards.
- Magstripe readers for reader cards.
- Sensitising/Desensitising unit.

## 3. The supply of self issue systems by vendors as single unit.

4. The lack of standards to define the interface between self issue/return systems and Library Automated Systems. The interface between self issue/return systems and library automated systems are, in most cases, unique and must be built from scratch each time a new combination of systems is used. A Library Automated System developer cannot develop an interface which will then work with all self issue/return systems. The situation is the same for the developer of the self issue/return systems.

All this has led to a situation where many of the ideals of Open Systems have not been fulfilled.

- Interoperability is compromised due the lack of a standard applications level communications interface between self issue/return system and library automated system.
  - Interconnectivity is compromised in two ways.

Firstly the provision of the system as a unified unit prevent the purchaser choosing the peripherals desired. The buyer must accept the scanner and sensitising/desensitising equipment as supplied. This would not be true of a non-self service circulation desk workstation where the terminal/PC, scanner and desensitising equipment can all be purchased separately with only constraints in terms of compatibility. Most scanners for example will now interface to a PC or terminal via the keyboard connection.

Secondly some self service systems are provided with only an RS232 interface to

the Library Automated System. Given the current dominance of ethernet as the cabling and base communications standard this is a severe limitation.

- Human Computer Interface standards and consistency are compromised. The self issue system is normally supplied not by the Library Automated System but by the company who provides the security system (Item tagging, sensitising/desensitising and sensing/alarm initiation at exits). This is true of the 3M, Bibliomaten and Raeco self issue systems. Though in some noteworthy cases the self service systems are built by those who developed the Library Automated System itself. BTJ's TOR-OUT, TOR-IN and TOR-M are a case in point.

This means an interface to a local PC system which is usually completely different from that used for OPAC, Community Information, Reviewing Personal Information etc.

This puts an extra burden on users in terms of their learning a new interface.

It also means that self service functionality which is usually provided via a unified OPAC is split across workstations in a way which has nothing to do with good design considerations but has everything to do with unnecessary technical constraints.

- Flexibility across organisations and as requirements change are also compromised. This is because the existence of the self service system as a standalone entity developed by a third party complicates and lengthens the process of modifying or adding functionality to the system.

Further consideration is given to Open Systems issues in the following Chapter.

#### 7.4 Security

The Project team believe that developers of self-service systems for libraries have as yet given insufficient attention to the additional physical security issues posed by self-service which, by definition, is not supervised by library staff. For example, the team were told by one supplier that the solution to such problems was to site equipment in full view of library staff! Such an approach ignores many of the potential advantages of self-service: for

example, being able to scatter self-service issue stations around the library (and perhaps do away with the traditional issue counter altogether) or 24-hour opening without 24-hour staffing.

There must be particular concern that the item identifier used by most librarians can so easily be photocopied and the identifier of a valuable item replaced by one from something of little value. This area needs much further attention (see Recommendation 3 on page 116).

The matter of security of payments and of user identifiers was discussed in Deliverable Report 2b. This is a fast-moving area: the team believe that there is considerable scope for libraries to adopt chipcard technologies for these purposes.

## 7.5 Other Issues

In addition to the open systems and security issues, the Project team identified a number of areas in which improvements should be sought. These include:

- the limited choice of systems on the market, which may be seen as at least partly explained by general non-compliance with open systems standards;
- generally poor design of end-user equipment;
- use of inappropriate technology. For example, the continued reliance on barcode technology for user identifiers when every other self-service function familiar to users utilises magnetic stripe or chipcard technology;
- poor accessibility for disabled, especially wheelchair bound, users and for those with visual impairments;
- insufficient attention to the privacy of users so that transaction details can usually be viewed by others in a queue. It is recognised, however, that these issues may be culturally determined and should not be taken as uniform across Europe;

- insufficient attention to the problems of exception conditions, so that too often users are forced to double-queue: once to be told by the self-service system that they cannot complete the transaction there and a second time at the staffed counter. In part, however, this problem must be seen as the librarian's responsibility where policies appropriate to staffed service are carried over into self-service without sufficient consideration of the consequences;
- self-service functions are generally not well-integrated, so that users have to learn separate interfaces for each function. This may, of course, be an issue of market immaturity and there is some evidence that solutions are emerging (see BTJ's approach for example). However, the emergence of integrated, proprietary products which ignore the open systems issues described elsewhere would not be a step forward;
- the issues associated with remote access to library functions have not yet been given sufficient attention. It is usually assumed that where a self-service transaction fails there will be a staff member available to assist. Increasingly this may be a false assumption;
- user authentication remains an issue. It is part of the integration issue, since users do not want separate passwords (or whatever) for each system or module. It is particularly crucial for the development of remote access. A front-end authentication module could be one answer to this (and would be a way of implementing the generalised functional specification). It could be that an international authentication service would provide an answer to the issue of access to international (e.g. database) services. Where the service involves the lending of returnable items it is obviously crucial that the identity and address of the user is fully authenticated.
- while the prices we were quoted for self-service issue systems during the Project were confidential, it was clear that they would be a major barrier to smaller libraries and all libraries in the LFRs. Cheaper solutions are needed, although security must not be compromised.

## 8 Open Systems Environment and Security

Key technical objectives of all IT based library systems ought to be those of 'Openness' and 'Security'. 'Openness' means that the system can share data with and interoperate with other systems. 'Security' requires among other things that unauthorised access to data will be prevented and that information cannot be modified by unqualified personnel. Particular attention was therefore paid to these issues during the Project, and the results reported in Deliverable report 2b. This Chapter contains a summary of those findings.

The key question to be answered was: 'What do we need to do to make self-service systems both open and secure?'. As shown by earlier work, self-service could be applied across a relatively wide range of library functionality. Just as the degree to which different functions could be implemented in a self-service mode varies so too does the degree to which each of these functions requires compliance with open systems standards and/or raises security issues. Provision of access to a library's catalogue is an example of an area of functionality where the usefulness of compliance with open systems standards is high. Many outside institutions may wish to search the catalogue. However, the requirement for security in this area is relatively low as bibliographic information is not of the greatest sensitivity. A contrasting area would be that of self-service access by a person to their own details as stored on the library computer. This is an area where compliance with open systems standards is less important. We would generally wish only to provide this information to the borrower in question and not to an outside institution or system. It is however an area where security would be of paramount concern. Not only would it not be the wishes of the vast majority of patrons that their details are not the subject of general scrutiny but in the cases of many countries it is a matter of legal obligation through data protection legislation that such unauthorised access be prevented.

These issues were explored in depth in Deliverable Report 2b, which demonstrated that the ideal of 'Openness' encompasses a range of goals:

**DATA SHARING:** The ability to exchange data and files between different hardware platforms, operating systems and applications.

**INTEROPERABILITY:** the ability not only to share data with other systems but also to be able to submit and accept requests for services to and from such systems.

**INTERCONNECTIVITY:** The ability of platforms, devices and networks to freely connect and communicate.

**PORTABILITY:** The ability to run software across a range of hardware.

SCALABILITY: The ability to move software easily through different levels of hardware, network power and complexity.

FLEXIBILITY ACROSS ORGANISATIONS: The ability to satisfy a range of information requirements.

FLEXIBILITY AS REQUIREMENTS CHANGE: The ability to change as information requirements change.

INTERFACE STANDARDS: The ability to fit easily into the overall human/ technical system.

The importance of each of these objectives in the realm of self-service systems and some of the standards and strategies which might allow them to be achieved have also been analysed in the above-mentioned Report.

A system that is 'open' lends itself to potential abuse by users trying to measure the level of security built into that system. Organisations that use an open operating system such as UNIX and offer standard communications protocols (Z39.50, TCP/IP) over the Internet increase the risk of unauthorised access to data, possible tampering and even data destruction. An organisation that relies on propriety systems with no external communications can maintain a higher security level more easily though this can lead to complacency. The risk from internal staff with authorised access causing wilful damage and the risk is of a natural disasters (fire, flood etc.) should also be stressed.

Measures against these threats must be taken to ensure the stability and integrity of the system:

- Prevention is better than the cure - for example, provision a virus detection system should be in place. The validity and integrity of the data must not be compromised and backup procedures must reflect this in the way they are carried out (for example, it's no use taking regular backups of a system if the data has been discretely tampered with over a period of time).
- Access rights to volatile data must be controlled and monitored carefully though the necessary accounting software.

- Physical security must be assessed regularly, all the encryption algorithms in the world are no use if an unauthorised user can walk up to the console of the mainframe and bring the system down.
- Network outlets that allow a user to plug in a laptop PC and filter off data or cause heavy network traffic to bring the network down must be monitored. Ethernet lends itself to this type of misuse and may influence a manager in the choice of network cabling and connectors.

The development of standards in a number of areas has helped to move open systems closer to achieving two major goals : Interconnectivity and Interoperability. These developments include :

- Operating systems - the development of hardware portable operating systems such as UNIX and Windows NT.
- Database Management Systems (DBMS) - The SQL compliant normalised relational tables in the case of many commercial DBMS's and RECALL in PICK's built in DBMS.
- Communications - the dominance of TCP/IP (on which the Internet is based) and IPX (protocol used by Novell Netware). The OSI seven layer model allows the a layer to be upgraded without disturbing other layers.
- Applications - standard user interfaces e.g. windows base, easy to change between wordprocessor and a spreadsheet application.
- Library Automation Systems - systems are able to share data through a range of standards.

Again, these areas were considered in detail in Deliverable Report 2b.



## 9. Cost Benefit of Self-Service in Libraries

### 9.1 Introduction

One of the motivations for installing self-service issue systems is to achieve efficiency gains through saving on staffing costs. The evidence from other sectors is that there are very considerable savings to be made from self-service. Note however, that these savings are frequently in the form of releasing staff to undertake more productive work.

Although there are few published studies of the savings made in commercial sectors, a representative of the banking industry was able to quote data from the United States that an average customer transaction costs \$1.07 when performed by a member of staff against \$0.27 when carried out at an ATM<sup>3</sup>. The evidence for staff savings is more indirect: it appears that at first staff released from counter duties were generally redeployed i.e. employers used them to improve customer service in other ways or to sell new services - in banking the expansion of ATMs has coincided with the growth of non-core financial services business. However, the evidence also suggests that if and when recession bites and savings have to be made, it is then much easier to make staff redundant (or freeze vacant posts) when self-service has become embedded. It also has to be said that there is a certain inevitability about such changes, since no-one would expect - taking a different example - that a telephone company would continue to employ large numbers of telephonists once it had gone over to automatic exchanges.

### 9.2 Staff Savings in Libraries

During the SELF project we discussed this issue with a number of libraries which have installed self-service systems and where possible obtained data from them. Crucial among this data is the question of the proportion of issues which can be handled in this way, since it is on this that quantification of benefits depends. An unpublished survey carried out in the UK by the Standing Conference of National and University Libraries (SCONUL) figures for academic libraries in the UK, ranging from 25% to 31% of total issues. Similar statistics have been reported from many other sites: for example, at Kalmar (a public library in Sweden) the figure is around 25-30%. However, there are also installations which report figures in the region of 80-90% of total issues (e.g. Tilburg University; Albuquerque Public). The reasons for this disparity appears to lie in the library policy adopted in two areas: one is that if the service desk is removed and staff made inaccessible (in one library in the USA users have to ring a bell to summon staff from a back room if they can't get the self-service system to work!). More crucial is the Library's policy on exception conditions. To achieve 80%+ it appears that it is necessary to operate

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<sup>3</sup> Quoted by Rogers at the 'Future or Fallacy?' Conference at the University of Sunderland, UK, June 1996.

a policy in which virtually no block will stop the lending transaction. By contrast those libraries reporting much lower percentages appear to operate a 'block' policy on a range of exceptions e.g. outstanding fines, book awaiting collection; book reserved by another reader, and so on. It would appear then that it is largely a management issue as to the percentage of self-service issues to be achieved.

During the Project some experiments were carried out to try to gain data on how much time was saved by self-service issue transactions. On the basis of these observations and assuming that 25% of transactions take place by self-issue the following graphs are presented as depicting the *possible* staff savings which could accrue. Clearly real changes in staffing can only take place in integer increments, so that for example once the library is reduced to one member of staff at the issue desk there are no savings to be made by diverting transactions to self-service: this is of course an approximation, since staff might be otherwise occupied for some of the time, or may be undertaking issue desk duties for only part of the time. Nevertheless it represents a reasonable model of the impact of self-service issue is likely to have on a typical library.

Fig. 9.1 shows the savings that accrue for hypothetical library for any period (A, B, C, D, E, F) in which varying numbers of staff are needed to provide a fully staffed service.

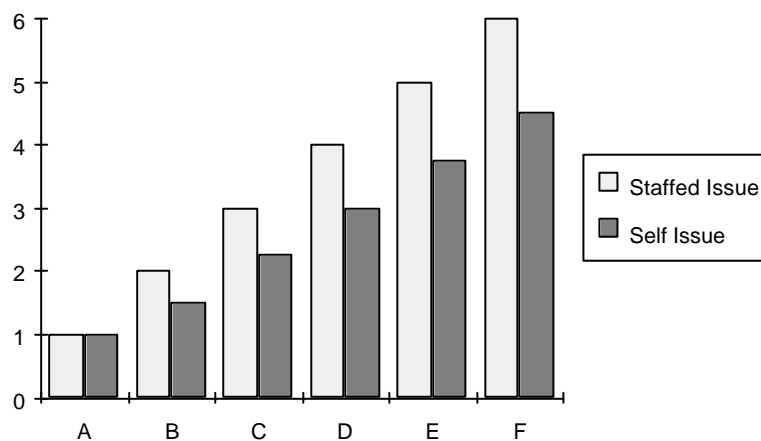


Fig 9.1 Possible staff savings from self-service issue

In a typical day the number of staff required at the issue desk varies from hour to hour depending on demand. Fig. 9.2 represents this pattern for staffed and self-service issuing:

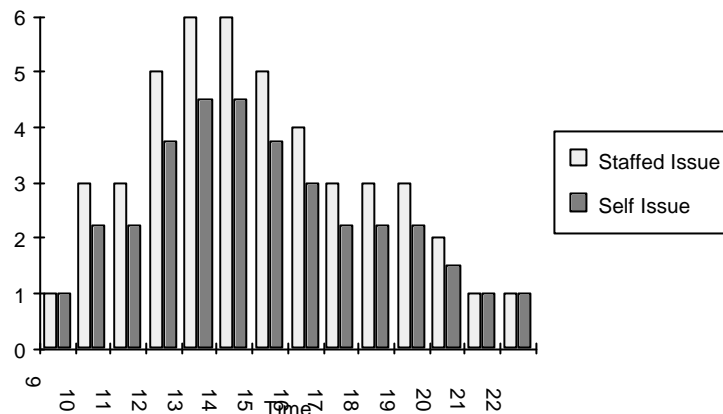


Fig 9.2 Possible staff savings during a working day

If this model is accepted the *potential* staff savings from self-service in this Library (the model is based on the University of Central Lancashire) amount to 11.75 hours per day, which would equate to approximately 1.5 posts. In financial terms this could equate to approximately 17,000 ecu per annum. For a variety of reasons it has not yet been possible to observe savings of this magnitude in any of the libraries we have examined. Partly this is explained by inadequate flexibility of staffing patterns to meet the new situation, partly by the use of self-service to reduce queuing at staffed service points (rather than to maintain service queues as staff numbers reduce) and partly by the fact that the systems are still being experimented with. However, there is no reason to believe that these estimates are unrealistic.

### 9.3 Cost-benefit

Clearly the above analysis concentrates on only one element of the cost-benefit equation, that of potential cost savings. Equally clearly, that is only one part of the total picture. While it was beyond the scope of the Project to undertake a formal cost-benefit study, the following elements are suggested as requiring analysis by any library considering the installation of self-service systems:

#### 9.3.1 Costs

- Capital cost of self-service equipment, amortised over a chosen period in accordance with accounting conventions;
- Installation costs, including building adaptations;
- Staff retraining;

- User training, publicity, etc.
- Replacement of item and user identifiers, if needed;
- Ongoing maintenance costs;
- Any losses accruing because of unstaffed services.

### 9.3.2 Benefits

- Reduction in normal staffing costs;
- Increase in service availability (benefit to users);
- Increase in service flexibility (benefit to users);
- Decrease in space requirements for library functions.

## 9.4 Conclusion

Although we did not have an opportunity to undertake a formal cost-benefit analysis during the Project, the evidence from other sectors and the brief analysis reported above do indicate that there is a positive cost-benefit from self-service functions in libraries.

Because issue transactions are the most staff intensive in most libraries it is these which offer the most opportunity for cost savings. A particularly interesting area is whether self-service offers scope for unstaffed libraries, on the model of the unstaffed bank branches which are becoming more and more common. On the other side there are definite benefits to be counted. As in any cost-benefit study these are very difficult to quantify, but the experience of users reported earlier would indicate that they are positive.

The exact savings to be made will depend on many factors: the characteristics of the Library; its opening hours; the percentage of transactions covered; and so on. Each library will need to assess these for itself.

## 10. Conclusions and Recommendations

The broad conclusions of the Project team in relation to the specific objectives of the project are:

- 'to assess library user requirements in the area of self-service library systems'

*Interviews and surveys showed that users would greatly value the extension of self-service facilities. There was less emphasis on security issues expressed by users but this was seen as the greatest potential pitfall for the service provider. Concern was expressed by users on the effects of staffing levels and that the human contact aspect should not be lost completely.*

- 'to examine the implementation of a self-service system and its operation'

*A self-issue system was implemented and monitored during the life of the project. It was well received by staff and users and important lessons were learned on design and implementation issues, especially in relation to open systems and security, and on the human aspects of self-service.*

- 'to explore the implications of the shift to open systems on self-service systems'

*The standardisation of various communication protocols e.g. Z39.50, TCP/IP and operating systems (UNIX, Windows NT) has allowed greater awareness and scope to develop systems but security for sensitive data involved in library transactions remains a key factor. There is an inevitable conflict between 'openness' and 'security' which needs constant attention in systems development.*

- 'to develop a generalised functional specification for self-service systems'

*A data model has been produced which not only allows a better understanding of what is required from each function but also has provided a sound basis from which software development could proceed.*

- 'to identify areas requiring further analysis and development'

*Most but not all self-service systems are being developed by the security suppliers (e.g. 3M, RAECO) and further pressure is needed on library automation suppliers to liaise more closely and in particular to develop standard protocols and interfaces. Examples of new self-service applications are needed, while encouragement of librarians across*

*Europe to invest in products is required. Existing self-service products need further development within an open systems framework.*

In addition to these conclusions, eleven specific recommendations are made:

**Recommendation 1.** *Encouragement should be given to the development of a self-service library systems interface standard, which would enable the development of open products. Some work has been done on this, but it needs to be pursued urgently since it would help to open up the market. An extension to Z39.50 would seem to provide the obvious approach.*

**Recommendation 2.** *There is a need for integrated self-service systems to be developed, to replace the one-off products which are currently the norm. In particular integrated self-service systems based on the model developed in the SELF Project would enable librarians to operate all their systems in an planned and co-ordinated fashion and would make systems more accessible to users through a common interface.*

**Recommendation 3.** *Security issues need to be further considered, and in particular the adoption of more secure item identifier symbologies and technologies should be a priority to guard library resources against theft and to enable wider application of self-service.*

**Recommendation 4.** *New identifier technologies, such as 'active badges', may offer considerable promise for library applications as and when they become available at economic cost. An experiment with these badges or similar identifiers would be a valuable contribution to the development of a new generation of self-service library systems.*

**Recommendation 5.** *It would be helpful to have a broader range of open self-service systems on the market, providing more choice for librarians and market opportunities for new players. The EC may have a role to play in encouraging this competition. The use of open systems is clearly important in this area.*

**Recommendation 6.** *Cheaper self-service systems (especially self-service issue systems) are needed to enable small libraries to participate in this approach. At present a single self-service issue point may cost upwards of 20,000 ecu: at this level small libraries and those in LFRs (Less Favoured Regions) will be excluded from participating.*

**Recommendation 7.** *There is little information available on the impacts of library self-service systems on users, on staff, on structures and on library layout. Work in this area should be encouraged.*

**Recommendation 8.** *Remote access to libraries and the enormous present and future growth of the Internet will present particular challenges to the development of self-service approaches: these need to be studied in detail. There are particular authentication issues which need to be addressed.*

**Recommendation 9.** *Steps should be taken to encourage better physical design of self-service systems.*

**Recommendation 10.** *The needs of disabled users (especially those with visual impairment) should be considered and steps taken to adapt self-service systems for their use.*

**Recommendation 11.** *Further studies of the challenges to libraries from the change from printed material towards digitally stored information are needed, especially to explore the opportunities and limits of self-service approaches to digital resources.*



## **Appendix: SELF Project Deliverable Reports**

All Project Deliverable Reports are available from CERLIM, University of Central Lancashire, Preston, PR1 2HE, U.K. Fax: +44-1772-892937; Email: l.cerlim@uclan.ac.uk).

- User Requirements and Implications (Deliverable Report 1)
- Operational Analysis (Deliverable Report 2a)
- Open Systems Environment and Security (Deliverable Report 2b)
- Generalised Functional Specification (Deliverable Report 3)  
[The core of this Report forms Chapter 5 of the Final Report]
- SELF Seminar: Self-service systems in libraries
- Final Report

Please send an email or fax for details of availability and current prices.

FINALRP6.DOC