

JISC DEVELOPMENT PROGRAMMES

FINAL REPORT

Project

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MLEs for Lifelong Learning

SHELL PROJECT

Final Report

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The SHELL Project (Southwest Hosts Enhancing Lifelong Learning) was one of two projects funded by JISC in early 2002 as part of the MLEs in Lifelong Learning Programme. The project was led by the University of Plymouth with Cornwall College, Exeter College, North Devon College and Somerset College of Arts and Technology as partners.

Also involved in later stages of the project were Weymouth College and three schools: Estover, Helston and Lipson.

The main software development was carried out by Phosphorix Ltd with assistance from ETL Solutions Ltd and Wynne Rees as an independent developer. ICO3 Ltd carried out the development of one of the software components.

The project especially appreciates the contribution made by Cornwall College in acting as lead site for data transfer and, in particular, the first class support received from Seddon Kirk.

The project also appreciates the support received from Paul Bailey and Lisa Gray of JISC.

Executive Summary

What were we aiming to do?

The initial aims and objectives were set out in a project plan which was agreed by the Project Board in mid-2002. These objectives can be grouped in the following way:

- Development of a generic infrastructure for exchange of student data using IMS, the developing standard which forms the basis of the MLEs for Lifelong Learning Programme.
- Transfer of partnership data between the University of Plymouth and its partnership colleges achieving:
 - single registration for partnership students
 - rapid and efficient transfer of data between consortium members
 - a mechanism for the transfer of results
 - a mechanism for students to register for access to the University's VLE
- Creation of a multi-institution Learner Record involving data from schools, FE colleges and the University, with students accessing their Learner Record via a permanent personal web portal.

Over 4000 students register at partnership FE colleges for qualifications to be awarded by the University. 'Double registration', the processing of registration data by a college and independently by the University, takes weeks to complete and is prone to error at both ends. Complete reconciliation of the data on college and University student record (SR) systems takes months. With payments to FE colleges and the award of qualifications being based on this process, keeping systems in step is particularly important.

With small and dispersed centres of population, specialist courses are not always available in local areas. Structures that support learning online can be especially valuable. Students, particularly those that pursue education at a number of different stages of their life or move from one institution to another whilst pursuing a course of study, stand to benefit from this access.

The concept of a lifelong learner record is powerful, potentially enabling learners to access a record of their development in the widest sense, irrespective of the life choices and pathways taken. Although initially targeting qualifications, the project aimed to design and develop an architecture that would facilitate the future storage of other records of achievement, such as personal development planning.

What did we achieve?

- Design of a multi-institution learner record based on qualifications.
- Design of business processes to support creation of an LR. This involved the storage of module information and the handling of multiple student identifiers.
- Successful creation of a test learner record database using data from 4 colleges and creation of a portal view ready for access by learners.
- Automatic transfer of data between systems in FE and the University resulting in update of the University's SR system and triggering access to the University's VLE. The process involved alignment of partnership data (different module codes in different systems and handling potential duplicates).
- Creation of a generic technical infrastructure for the transfer of IMS LIP between systems (ioNode) with the design necessary to scale up to a national level.

Did the project proceed as expected?

Although the project met almost all of the original aims and objectives, a number of issues slowed progress.

- The software supplier over-committed in undertaking development of software for the project. Having been scheduled for one year, development to the stage where the infrastructure could

support the business processes took two and a half years, a severe blow for a 3-year project. This significant delay removed much of the opportunity to use the infrastructure to meet the further aims of the project.

- The project received a poorer level of support from the University than originally expected. Technical staff involved in supporting the project already had a full workload and it was not possible to turn available project funding into extra resources. Problems were compounded by pressure from within the University for staff to work in other areas.
- The business processes associated with partnership students are not well supported within the University and this was seen as an opportunity to adopt transfer mechanisms developed by the project. However, any change to business processes is particularly difficult via a project that has no formal institutional responsibility for such processes.

What's happening next?

Other projects are now commencing to take the idea of a lifelong learner record forward based on the start made by the SHELL project. However, before a lifelong learner record could be considered to be successful, the shift from regional pilot to national facility is a significant divide that needs to be bridged.

1 Background and Initial Aims

The initial aims and objectives were set out in a project plan which was agreed by the Project Board in mid-2002. Working with partners and software suppliers the project aimed to provide:

- a framework for integration of the Managed Learning Environment (MLE);
- improved efficiency for the administration of partnership students (students enrolled on a University of Plymouth course at an FE college);
- access to partnership Virtual Learning Environments (VLEs) for partnership students;
- a framework for the seamless movement of the learner within FE and between FE and HE;
- a record of lifelong learning within the region for FE and HE students.

Partnership Students

Over 4000 students register at partnership FE colleges for qualifications to be awarded by the University. 'Double registration', the processing of registration data by a college and independently by the University, takes weeks to complete and is prone to error at both ends. Complete reconciliation of the data on college and University student record (SR) systems takes months. With payments to FE colleges and the award of qualifications being based on this process, keeping systems in step is particularly important.

The project aimed to achieve single registration at the delivery institution, the FE college, with automatic transfer of data to the University.

Access to the University's VLE by Partnership Students

At the start of the project, the University was planning to give all partnership students access to its VLE but the mechanism for handling partnership data was not nearly rapid or reliable enough to support this. The project aimed to be instrumental in providing students with this access within one to two days of registration by the student at a partnership FE college.

With small and dispersed centres of population, specialist courses are not always available in local areas. Structures that support learning online can be especially valuable. Students, particularly those that pursue education at a number of different stages of their life or move from one institution to another whilst pursuing a course of study, stand to benefit from this access.

Multi-institutional Learner Record

The project aimed to pilot access by learners to a multi-institutional learner record. A learner record which accumulates as learners move from institution to institution is particularly important as part of the national agenda for widening participation and personal development planning. In piloting a multi-institutional learner record, the project aimed to produce a viable model that would be scalable nationally.

2 Aims and Objectives

The original aims and objectives set out in the project plan remained throughout, apart from the following two changes.

Firstly, the project experienced difficulties in recruiting and retaining a Technical Team Leader to coordinate the technical design and development. In attempting to resolve this problem the project came to use the services of a small Exeter company, Phosphorix, after having had a number of planning discussions with student record system suppliers, JISC and CETIS. Having discussed proposals at a Programme meeting in Belfast in late 2002, Phosphorix undertook to carry out the design and development according to the revised business process specification and the learner record specification (see section 4) which had by that time been produced by the project. In essence, the plans involved developing a more generalised infrastructure for the transfer of IMS data than had

originally been envisaged. The plans were subsequently adopted by the project which then entered into a contract with Phosphorix for delivery of the infrastructure within approximately the same timescale as the original project plan.

Secondly, it was originally intended that the project would involve solely the University and a number of its partnership FE colleges. However, it became apparent that FE colleges saw significant potential in starting the process at school level. Although this had been seen as a possible extension of the project beyond 2005, opinion in the FE colleges was so strong the Project Board agreed to include 3 schools in the final phase of the project.

With these changes, the focus of the project became grouped around 3 main objectives:

- Development of a generic infrastructure for exchange of student data using IMS LIP, the developing standard which forms the basis of the MLEs for Lifelong Learning Programme.
- Transfer of partnership data between the University of Plymouth and its partnership colleges achieving:
 - single registration for partnership students
 - rapid and efficient transfer of data between consortium members
 - a mechanism for the transfer of results
 - a mechanism for students to register for access to the University's VLE
- Creation of a multi-institution Learner Record involving data from schools, FE colleges and the University, with students accessing their Learner Record via a permanent personal web portal.

3 Methodology

3.1 Partnership Data

The approach taken by the project for the timely transfer of partnership data was one of single registration at an FE college with data being transferred rapidly and automatically to the student record system at the University. This has the benefit of minimising the impact of registration on the student (one registration process at the delivery institution) and of keeping college and University student record systems in step.

An alternative, suggested within the University, was to have partnership students register via the University's on-line registration system. However, although this might address the University's needs at registration time, students would have to register separately at the college (resulting in all partnership students having to fill in two registration forms) and, perhaps more importantly, the difficulty of reconciliation between college and University SR systems (a major disadvantage of the original paper process) would remain. Under this approach, whenever students wished to change course or optional modules, there would need to be additional college and University processes.

Reconciliation between the two SR systems is a vital aspect of the HESES process by which colleges receive payments, as highlighted in a recent HEFCE audit report. Reconciliation, where there has been separate data entry, is enormously time-consuming - it normally takes until November when the HESES return is due and even then is only carried out in an approximate rather than rigorous way.

The approach selected by the project has the following advantages over the alternative:

- Reconciliation made markedly easier by achieving a more rigorous and auditable data transfer process between systems
- A more coordinated view of partnership processing by the student

3.2 Learner Record

The original project plan included two phases: the first phase of development of the multi-institution learner record was to be based on qualifications completed and in progress; the second phase was to extend this version of the LR to include skills and competencies.

A portal, to give learners access their records, was included as part of phase 1 and it was intended that pilot groups of learners would be involved in its design. Features discussed at the outset were that learners should be able to select appropriate areas of the record for printing and for prospective employers to be given access to a copy.

3.3 Different Models for Provision of a Learner Record

When accessing a Learner Record, the main issues for a learner are:

- Is the record complete?
- How long does it take to get the information?
- Is access to the record reliable?
- Is it secure?
- What can I do with it?

There are two main approaches to provision of an LR: one is to collect data from the relevant systems within an institution and record these in a database, perhaps at a regional or sub-regional level (**the storage model**); the second is to request data from the relevant institutional systems and present it to the learner when required (**the request model**).

The project considered both approaches. It was considered that the request model would not be sufficiently robust to scale up properly. Without any storage at all, not even an index of learner records, requests would have to be made to *all* institutions to see if a particular learner had been registered there in the past in order to draw together the learner record. Systems may be slow to respond or may not respond at all and, if one system were not to reply, the portal would have no way of knowing whether a learner record was complete.

It would be possible to avoid having to make a request to all participating systems by maintaining an index of the locations where parts of each learner record needed to be drawn from (**partial storage model**). This moves closer to the storage model and removes the main disadvantage that would be encountered with the request model.

The storage model was felt to be far more robust and scalable. It can accommodate delays in transferring data out of the source student record system better than the request model, could support a batch link between systems and would be independent of any archive policy applied to the source student records system. This was model adopted by the project.

	Storage model	Request model	Partial Storage model
Is the record complete?	<ul style="list-style-type: none"> ○ With data being gathered before the time that it is requested by the learner, the storage approach is independent of the responsiveness of the source operational systems when the LR is required. ○ Institutions would be able to archive data whenever suitable. 	<ul style="list-style-type: none"> ○ Relies on all possible operational systems working in a responsive way when the LR is required. ○ Institutions would not be able to archive data. 	<ul style="list-style-type: none"> ○ Relies on those operational systems that contain parts of the LR working in a responsive way. ○ Institutions would not be able to archive data.
How long does it take to get the information?	<ul style="list-style-type: none"> ○ Having the data already assembled as a body of learner records is potentially fast. 	<ul style="list-style-type: none"> ○ Having to request data from potentially a large number of different systems is likely to be very slow. 	<ul style="list-style-type: none"> ○ Speed of access is likely to be midway between the other two models.

Is access to the record reliable?	<ul style="list-style-type: none"> Having gathered data from operational systems before it is required means that display to the LR should be much more reliable than if data had to come from operational systems the instant that it's required. 	<ul style="list-style-type: none"> To display an LR requires responses from a relatively large number of systems the instant that the LR is required and this would be less reliable than the storage model. 	<ul style="list-style-type: none"> Reliability lies between that of the storage and request models.
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3.4 Technical Infrastructure

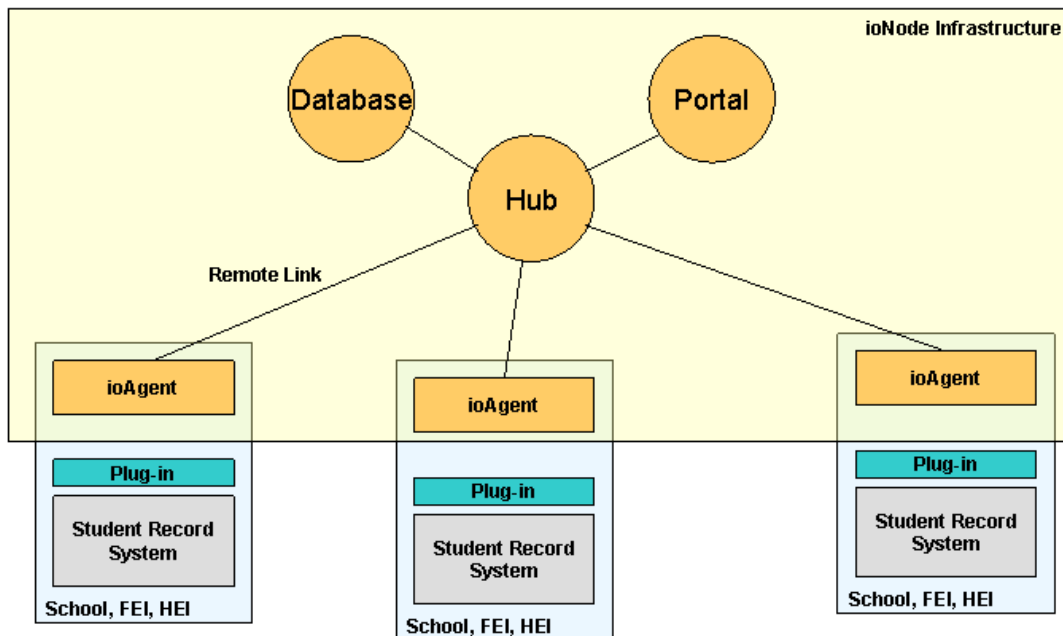
The generalised software for transfer of data between systems using IMS LIP was designed by Phosphorix with advice from CETIS. This became known as ioNode (interoperability node) [22].

The components of ioNode are:

- **ioAgents** which are located at each institution to convert data, where necessary, to IMS and to send the data reliably and securely to a central hub. Data can be moved either on an individual transaction basis or as part of a batch.
- **ioHub** which acts as the central point of communication for ioAgents and the Learner Record database
- **ioDB** is connected to the hub and contains the learner record database and its associated index.

The ioNode software uses SOAP and ebXML to transfer IMS LIP data between institutions. It is based on a number of open-source components [22]. Fuller technical details of ioNode are available via www.ioAgent.org.

ioNode Infrastructure



Other technical components required by the project are:

- **A plug-in** for each institution that extracts relevant data from the institution's student record system and presents this to the institution's ioAgent.
- **A portal** by which learners can gain access to their learner records

3.5 Scalability – Regional Clusters

Within the ioNode framework, scalability can be achieved by replicating the regional or sub-regional clusters designed to support the SHELL project. Hub to hub links would be required so that a single multi-institution learner record would be created even when learners moved from one region to another. Realisation of these links was built into the ioNode design.

3.6 Why Store the Learner Record as IMS?

Alternatives for storage of the learner record data are to store data in standard relational form or to store data in IMS form. Using IMS has several advantages:

- Data in transit through the hub to the database is already in IMS form and would require no conversion before addition to the database
- Data transferred from the database would again require no conversion in order to be sent back through the network
- An IMS database could be used to store a wider variety of IMS data, for example PDP, without extension to the basic structure.

The weakness of IMS storage is that updating an existing IMS record for a learner would be more complicated than for a relational model. However, on balance the project decided to follow the recommendation by Phosphorix to use IMS.

3.7 Data Controllers

The project adopted an approach whereby each institution acts as data controller for the data sent by the institution to the learner record database. This included setting up an agreement covering the terms and conditions under which the University would process the data on behalf of the colleges.

Having multiple data controllers is fine at this pilot stage of creating a learner record database but, in the longer term, advice from Andrew Charlesworth, leader of the JISC-funded legal study, is to have a single data controller. Within a national context, UCAS or DfES may be appropriate data controllers but it is less easy to identify a suitable regional data controller to move the focus first of all from project to regional level.

3.8 Duplicates

Duplicates were identified as a potential problem at an early stage of the project. There are 3 types:

- Duplicate records within the source student record system – these arise when registration data is processed within an institution without the institution realising that a record already exists for the student.
- Potential duplicates within the partnership – these relate to the import of data into the University's SR system. Transfer of partnership data from a partnership college to the University can give rise to potential duplicates if data for an incoming student matches a record already on the University's SR system with respect to basic personal details. Without the University holding a college identifier that can be used to determine if data has been sent on this student by the college previously, such potential duplicates need to be inspected at the Plymouth end and a decision taken. However, although storing a college identifier may reduce the number of potential duplicates, it cannot remove the problem altogether. Students may already have made an enquiry at the University, and so gained an entry in the enquiry part of the student record system, or may have registered on a partnership via another partnership college previously.

- *Duplicates within the learner record database* – these could be caused by an institution not identifying that a student already has a learner record via a previous institution.

The number of the first type should be small and administrative procedures already existed within institutions to eliminate these. The second type relates to the movement of data between partnership institutions and, once more, procedures already existed to handle these. The third type, which is more specific to the project, is difficult to address until the learner record has sufficient coverage that it would be worthwhile institutions building questions into registration procedures to discover previous learner record involvement. At this pilot stage, it was agreed that it would be sufficient to have a facility to warn administrators about potential duplicates so that these could be eliminated later.

3.9 Identifiers

Multiple identifiers are used for learners throughout their lifelong learning experience and it is clear that this is not about to change in the near future. As a result, a decision was taken to allow the storage of multiple identifiers for institutions to use to reference learners. This approach is open-ended and can be used, for example, to store an institution identifier for each institution attended, a common school reference number, a Connexions number and, were one to be adopted at some stage, a unique learner number.

3.10 Evaluation

The approach taken by the project was judged to be appropriate in terms of task division and role allocation. The 'four team' approach worked effectively, providing structure and areas of responsibility although it was noted that in practice a number of tasks were shared between teams.

The evaluation of the learner record portal provides one example of this cross team partnership. A small scale evaluation study was undertaken to find out 'what learners want' from such a record of their lifelong learning. The results of this were published in the ASCILITE conference proceedings and made available on the SHELL project website.

In terms of project methodology, evaluation and team reports highlighted the significance of the early loss of the central technical team member. The lack of ability to attract applicants with suitable qualifications/experience for interview indicated that the project was possibly offering remuneration somewhat below the market rate. Had the project chosen the route of paying a market supplement, progress may have been quicker in some respects, but some of the value of working with external companies would inevitably have been lost.

The final evaluation report pointed to some of the difficulties in working in partnership with commercial software suppliers, and part of this problem may lie in the emergent nature of such projects. From the commercial partner perspective, development work is likely to be attractive only when clear future rewards are present.

4 Implementation

4.1 Project Planning

The project plan agreed early in the lifetime of the project covered:

- Membership of the Project Board
- Team leaders and a project manager
- A set of deliverables or products
- A set of timescales by which these should be delivered
- A mechanism by which the products would be assessed

An agreement was drawn up between the consortium members that covered the payments that would be made from project funds to members on completion of the various products. This was an

important framework that was maintained throughout the project. Actual assessment of products was carried out by a different team to those involved in product development.

Project Phases

The first phase of the project was to cover implementation at the University of Plymouth, Cornwall College, Exeter College, North Devon College and Somerset College of Arts and Technology. A second phase was to cover implementation at a further college and 3 schools, and also extension of the LR to include skills and competencies.

Project Teams

Four project teams were formed covering reasonably distinct areas of the project, each led by a team leader and each with a member from each consortium institution:

- Business analysis and implementation (BA&I)
- Learner record design (LR)
- Technical design and development
- Evaluation and dissemination (E&D)

Institutions recognized that the objectives of the project were ambitious and that not all the effort involved would be funded by the project. The estimated contribution from institutions was 50%.

4.2 Specifications and Agreements

Design of a multi-institution learner record based on qualifications [11] was completed early in the lifetime of the project after consultation with the LR team and the CRA. This was followed shortly after by a specification of the revised business processes needed to support partnership data transfers and creation of the learner record [12]. Together these two specifications represented the user requirements for subsequent technical development. The specification of revised business processes covered the need for a portal by which institutions could monitor and where necessary maintain data within the LR database (administrative portal). Later in the project this was expanded into a fuller specification [13].

A data processor agreement [14] was drawn up to reflect the terms under which the University of Plymouth would process learner record data on behalf of other consortium members. Colleges remain the data controllers for the data that they provide, with the University acting purely as a data processor and having no access to non-Plymouth data other than in a technical support role. Each consortium member signed this agreement which then formed the basis for management of the LR database.

4.3 Plug-ins

It was originally envisaged that student record system suppliers would produce the plug-ins necessary to interface their systems to ioAgents using IMS LIP as the data transfer format. Initial discussions included both student record and VLE suppliers but it soon became clear that the focus of the project would involve access to data mainly on student record systems. Discussions continued with Capita, FD Learning and Campus IT (all suppliers of student record systems to consortium members) but it was not long before FD Learning said that they were finding involvement with multiple JISC projects difficult and withdrew, preferring instead to continue work on IMS Enterprise with the JISC SWANI Programme. Campus IT only involved sales staff and this left effective discussions continuing only with Capita. Capita's involvement with the project diminished when all development resources were committed elsewhere during 2003-2004.

At that point, Technical and BA&I team members decided that colleges should develop their own plug-ins using a modified CSV interface [15]. It was felt that a CSV-type interface would be simpler than IMS LIP as a temporary expedient, and Phosphorix agreed that the mapping to IMS LIP could take place within the local ioAgent.

Consortium members agreed to fund the purchase of an ioAgent out of project funds, with the exception of North Devon College which had already committed the funding agreed originally. Instead, North Devon decided to develop its own IMS LIP interface and to use this to communicate directly with the hub. Having developed an interface to extract data in IMS form, the College underestimated the complexity of communicating directly with the hub using SOAP and ebXML. In order to resolve this difficulty, the project loaned the College an ioAgent and work was commissioned from Phosphorix to create an IMS receiver for ioAgent to sit alongside the CSV receiver. Data files were sent using a secure link to the ioAgent located in Plymouth.

4.4 Technical Infrastructure

Development of the technical infrastructure was adversely influenced in late 2003 and early 2004 by the unfortunate personal circumstances of Selwyn Lloyd, Managing Director of Phosphorix. When it became clear that this was likely to have a serious impact on the work undertaken, Phosphorix entered into an agreement with ETL Solutions for development work to be carried out under subcontract. ETL Solutions used its Transformation Manager to convert CSV data from the plug-in to IMS LIP and also developed ioDB using Xindice, database software from the Apache Foundation, selected by Phosphorix for storing data in IMS form. Having been scheduled for delivery in September 2003, the first delivery of the infrastructure took place in February 2004.

Following this first delivery, a number of serious setbacks prevented the completion of acceptance testing for a further 15 months.

- In early 2004, shortly after the first version of ioNode had been delivered, it was discovered that data was transferred by ioNode without security and that the data transferred to Plymouth, having undergone transformation to IMS and back again, did not match exactly data initially sent by the college.
- In mid 2004, a major problem was found with the database - even with the consortium identifier available as primary key, the database was taking an inordinate amount of time to retrieve records.
- In late 2004, it was discovered that no indexes had been built on the database.
- In early 2005, it was discovered that there was a problem with updating records.
- Once this latest problem had been fixed and acceptance testing resumed, it was discovered that the database index permitted only one identifier per student, something that would have restricted development of a learner record by multiple institutions.

Remedial action for each of these was taken primarily by Phosphorix with ETL Solutions and Wynne Rees being involved at different stages. Wynne Rees had worked on earlier stages of the project when employed by ETL Solutions.

ioNode was used to transfer live partnership data in September 2004 but the problems with the database that continued throughout 2004 prevented use of the learner record until early 2005. Such major delays to the technical infrastructure could only be attributed to underestimation by Phosphorix of the overall development task. A further contributing factor was that Phosphorix was essentially a developer of *systems* rather than *applications* software and did not adopt standard application development techniques. There was little opportunity to see the software operate at applications level until acceptance tests were being carried out.

Technical delays had an enormous impact on the original project plan.

4.5 Business Processes and Partnership Data

September 2003

It became clear that there were delays with the contract for development and implementation of ioNode some weeks prior to the first transfer of partnership registration data that was due to take place in September 2003. As a consequence, the BA&I team agreed that CSV data should be transferred directly, bypassing the ioNode infrastructure completely.

Cornwall College, as lead site for the transfer, transferred the first live partnership registration data in October 2003, having sent test data on a number of previous occasions. When this data was processed by the data import plug-in developed by the University, it became apparent that there were a large number of potential duplicates between the incoming data and records already in Hemis, the University's student records system. Potential duplicates were identified when there was a match on surname, first name and date of birth. It transpired that approximately 35% of the students had been on partnership courses before and, without a cross-reference within Hemis to the Cornwall identifier, potential duplicates needed to be inspected manually. Although there was a procedure for handling potential duplicates for incoming electronic data, when receiving data from UCAS for example, the scale was such that the capacity of the manual exception procedures was exceeded. When it became clear that a deadline set by Plymouth Registry could not be met, the Registry asked for registration data to be sent on paper.

Cornwall College had put considerable effort into implementing the revised business processes and into developing the software to extract the relevant data from the College's UNITE student record system. When asked to send paper records, Cornwall felt that their effort had not been reciprocated by the University and suspended involvement with the project for a period of months. The College felt there had been ample opportunity for Plymouth to discover the scale of potential duplicates when test Cornwall transfers had been processed in preparation for live running.

September 2004

Cornwall College set up a regular nightly transfer of partnership data prior to the September 2004 registration period. The plans were for the University to process this data on the evening of arrival. A new piece of software had been developed by the University to allow administrative staff to view the incoming data from a college alongside the existing Hemis data so that an administrator could quickly opt to either add or merge the incoming data. Once selected, add or merge then took place automatically. The target timing was to transfer information back to the college to permit partnership students to access the University's VLE within 24 hours, even when potential duplicates were encountered.

Unfortunately, this target was not always met, leading to further frustration at Cornwall College. The reason may have been that no proper routine was established for processing the incoming partnership data (this always required some technical intervention), or that no proper routine was established for the processing of potential duplicates within the Registry. It is surprising that the University, as a net beneficiary in the revised mechanism for partnership data, did not put more effort into making sure this process operated smoothly.

4.6 Learner Record Duplicates

Elimination of learner record duplicates relies on co-operation between institutions, but institutions were not keen on the work involved. It was clear that it would be difficult to get commitment from institutions until learners themselves stood to benefit from the pilot.

There is a potential data protection issue in eliminating duplicates that applied where multiple data controllers are being used. In order to eliminate a duplicate that has been created by input from two different institutions, both sets of data would have to be inspected. Since the institution attempting to resolve the potential duplicate would only be the data controller for one set, provision would need to be made within the data processor agreement for the administrator to be able to access the second set also.

4.7 Learner Record and Student Portal

September 2003

Delays in the development of the database component of ioNode meant that no progress could be made on creation of a Learner Record in 2003.

September 2004

Once more, problems with the development of the database element of ioNode meant that no progress could be made on creation of the LR database in 2004. However, towards the end of 2004, it appeared that ioDB was almost ready, and a contract was given to ICO3 to develop the learner portal according to a specification prepared by the project [16]. Development of a web-service link between LR database and portal was carried out by Wynne Rees and Phosphorix [28].

Having started work on the portal in October 2004, ICO3 had a first version of the portal ready for testing in March 2005 [42].

4.8 Institutional Commitment

Schools were only affected by the learner record aspect of data transfer and readily offered to be part of the project purely on the basis that they could see the value of a lifelong learner record to their students. They could also see that schools were the logical starting point. However, the technical delays prevented this initial interest from schools being properly developed.

All FE colleges had a relatively high level of commitment towards getting the transfer of partnership data working properly. This was particularly so for Cornwall College which acted as the lead site for partnership transfers.

The University's commitment was disappointing. As the centre of a large existing partnership, the University failed to lead the changes that the project was attempting to bring in via the relationship it already had with consortium members. The project was left to drive the change and the colleges had a somewhat unclear view of what it was that the University, as opposed to the project, wanted them to do. Timescales set by the project were not followed in the way that they would have been if set by the University.

4.9 Evaluation

Notwithstanding the previous comments about the disappointing level of University commitment, the final evaluation report noted that *"there is now consistency for registration of students and exchanging data on modules"*. Achieving this proved to be a significant task, but one judged to be very much worthwhile. Although the reliability of data transferred has improved, the issues of updates & duplicates remain.

This project occurred at a time where the University was undergoing a period of significant change, most notably with changes in Chancellery and the adoption of new records systems. Although this inevitably had some impact, a significant issue encompassed the interaction between various parts of the University (such as Registry) and the project team. Part of the issue here related to exactly how 'matched commitment' was being achieved within the institution, and the lack of clarity on this part proved to be problematic in terms of securing support. Evaluation reports made reference to the need for *"long term goals and commitment"*. Future projects may judge it worthwhile to secure clear agreement a priori as to what level of commitment and matched resource allocation is required.

5 Outputs and Results

5.1 Initial Specifications and Agreements

Early stages of the project saw completion of:

- A specification of a multi-institution Learner Record based on qualifications gained and in progress [11].
- A specification for revised business processes to support the automatic transfer of partnership data between colleges and the University and to support creation of the multi-institution learner record [12].

- An agreement for the terms and conditions under which the University of Plymouth would manage the Learner Record database in compliance with the Data Protection Act [14]. This has been signed by all consortium members.

These formed the basis of the user requirements for development of the ioNode infrastructure and paved the way for consortium members to share data.

5.2 Technical Infrastructure

Implementation of the ioNode infrastructure for the project was finally signed off in May 2005 with certain limitations. The main limitation was that ancillary learner identifiers (those provided by an institution in addition to the learner identifier used locally, e.g. Connexions or Unique Candidate Identifier) are not stored in the index. These fields cannot be used in a search and do not enter into the processing when a new record is being stored, adding to the risk of creating duplicate records.

ioNode can support the transfer of data on a transactional or batch basis receiving data either in the CSV form primarily used by the project [15] or in IMS LIP. All data is transmitted between nodes and stored within the learner record database as IMS LIP. CSV data is converted to IMS LIP at the local ioAgent.

5.3 Data Transfer

Planned data transfers have taken place from each of the FE colleges to the LR database with, for partnership students, data also routed to the University. The table below provides a summary:

Institution	ioAgent installed	Plug-in/ interface Developed	Plug-in/ interface Tested	Partnership transfers completed	LR transfers completed	Nightly Transfer established
Phase 1						
Cornwall	✓	✓	✓	✓	✓	✓
Exeter	✓	✓	✓	✓	✓	✗
North Devon	✓ (UoP)	✓	✓	✓	✓	✗
SCAT	✓	✓	✓	✓	✓	✗
University	✓	✓ (Data import)	✓	✓ (Cornwall)		✗
		✓ (Data export)	✗		✗	✗
Phase 2						
Estover	✓	✗	✗		✗	✗
Helston	✓	✗	✗		✗	✗
Lipson	✓	✗	✗		✗	✗
Weymouth	✓	✓	✓	✓	✓	✗

✓ Completed ✗ Not completed

The background to the summary is:

- Cornwall College achieved the transfers expected, and these were carried out close to the timescales of the project plan.
- Exeter and SCAT also achieved the transfers expected, albeit later than originally planned.

- North Devon, having decided to use IMS as the basis of transfer, ran later than other colleges.
- The University processed incoming partnership data from colleges but this process was not established as an automatic activity and continued to rely on technical intervention.
- Incoming data was processed live from Cornwall, triggering access to the University's VLE for Cornwall partnership students.
- The University did not test or use the plug-in developed by ETL Solutions for transfer of Plymouth students to the LR.
- Weymouth completed a test transfer using a plug-in for UNITE developed by ETL Solutions.
- Plug-ins for schools, ordered from ETL Solutions in early 2004, failed to be delivered. The late running of ioNode acceptance testing prevented attention being focussed on getting the plug-ins developed another way.

5.4 Administrative Portal

A specification was produced for the administrative portal that would allow administrators in institutions to monitor and, where necessary, maintain data in the learner record database [13]. This specification was produced in the second half of 2004 as an expansion of the outline included as part of the specification of redesigned business processes [12].

The administrative portal was developed by Phosphorix [43] and now forms part of the ioNode infrastructure. However, the portal meets the specification only in a loose way, as is perhaps another example of the lack of applications focus by Phosphorix. The main limitations are:

- The software is particularly unfriendly for college application administrators for whom it is intended.
- The function to link two learner records in order to remove duplicates was not implemented.
- Maintenance of the list of institution user accounts, based on Mambo, carries a huge number of inappropriate software configuration options for user access.
- There is no separation by institution in the maintenance of accounts. An administrator who has the privilege to add and edit accounts for one institution can do so for all institutions.

5.5 Learner Record and Student Portal

The student portal was developed by ICO3 with provision for selection of visual preferences to support accessibility. This uses a web-service link to the database provided by Phosphorix [28] and was tested and signed off in May 2005. The student portal [42] uses the logo 'MyTrail' and provides the facility for learners to self register for access and to then select their own username and password for subsequent access.

Because of the late-running of technical development, there was no opportunity to obtain feedback from learners on the portal within the timescale of the project.

5.6 Test Bed

Early in 2004, JISC provided funding for an ioNode test bed to be established. The aim of the test bed was to set up a test ioNode infrastructure that could be used by projects, including the regional pilots funded by JISC in 2005, to:

- Transfer IMS to a test LR database, with subsequent inspection of the stored IMS via the LR portal as an aid towards more standardised mappings from operational systems to IMS.
- Promote exchange of IMS between institutions via creation of a library of IMS data that could be inspected and retrieved by others.
- Provide an easy-entry way of testing new applications of the transfer of IMS.

Two meetings were held at the JISC offices in Bristol involving staff from JISC, CETIS, NIIMLE, SHELL and Phosphorix to map out the work package. It was agreed that:

- The test bed would initially replicate the SHELL infrastructure with at least one ioAgent.
- Documentation would be provided on:

- Download and installation of ioNode
- ioNode Configuration
- Developing a Transform
- Interfacing directly to the Hub
- ioDB Web Services
- ioNode would be extended so that it was capable of processing extended versions of IMS, illustrating this by the capability of processing PDP data from a recognised system such as LUSID
- The web services associated with ioAgent would provide support for an institution to request an IMS record from the database.

A demonstration of the initial set up of the test bed took place at the JISC offices in Bristol on 21 January and a further demonstration took place at the Programme Meeting in Birmingham on 22 February. The testbed is now available for use by other projects [44] with associated documentation [24-28].

5.7 Availability as Open Source

ioNode, including the administrative portal, is available along with the student portal as open source by registering at www.ioAgent.org, a site maintained by Phosphorix with sponsorship from JISC.

5.8 Evaluation

The final evaluation report noted that although the project achieved a number of shorter range goals, (data transfer) the contribution in terms of the wider (and perhaps more ambitious) aims was less in evidence. (See the project website for full versions of the evaluation documents.) In addition to aspects discussed previously, significant issues encompassed the following:

- Differing interests between the project and technical companies in terms of development. For example, the project focused on the application of the approach to this specific instance, and the software companies took a more generic view.
- Lack of buy-in and matched commitment (in particular from the University) proved to be an important issue, and changes in terms of the level of commitment were noted over the life of the project. *“SHELL was seen as a project without the full weight of the University behind it.”*
- Communication of project (and programme) objectives could have been improved. It was acknowledged that an earlier development of the project video would have helped communicate the longer term goals to the participants.
- Project evaluation approaches could have been simplified. In practice, a number of developmental steps were subject to evaluation, and this could have been usefully reduced by collating and compacting the number of stages evaluated.

6 Outcomes

6.1 Technical

- The ioNode software developed as part of the project is available as open-source within the sector. This should now prove valuable to other projects and institutions, both in its present form and as a basis for further development.
- The development of plug-ins by institutions themselves proved far more successful than development by a software supplier. This should be the recommended route wherever technical effort is available internally and otherwise it would be preferable to use assistance from another institution.

6.2 Business Processes

- The revised business processes introduced by the project were successful in supporting the creation of a test learner record database and in aligning student record systems at an FE college with the student record system at the University throughout the process of registering partnership students and recording module selections.
- However, use of the revised business processes to keep two systems in step throughout a prolonged period of update (course withdrawals, module withdrawals, recording of results etc) was not tested because of the extremely late arrival of properly functioning ioNode software. The University would have required at least one annual cycle of monitoring potential updates before making such updates automatic.
- The recording of module information for partnership students was found by at least two colleges to have value outside the context of the project. One college went as far as including module information for all its courses, which was then used to support a range of other processes
- Differences found in business processes between FE colleges and the University resulted in several unexpected issues. These reveal some of the complexities of aligning different business processes.
 - At the outset of the project, the project team assumed that associating the course and module codes used at the various FE colleges with those used at the University would be a relatively simple task. Surprisingly, this task took over 6 months. The existing manual processes disguised the time-consuming translation when FE data was being entered at the University. The University's Partnership Faculty considered the mapping carried out as part of the project to be of significant value.
 - The data held by the University at the outset of the project was found to contain unexpected inaccuracies. A file of names of students expected to be returning for a further year sent to colleges from the University's SR system contained the names of students who were known by the colleges to have left some years before. This is indicative of some of the data inconsistencies being introduced by double registration and must cause doubt about the relevant parts of the HESES returns.
 - The University holds only the modular data appropriate to the current year when a partnership student is registered. However, when partnership data arrived from Cornwall, it contained module information not just for the current year but for all years of a course. Cornwall College registers students for the whole course rather than just the current year and this mismatch of business process may have contributed to the unexpected inaccuracies described above.
- A recent drive by the University of Plymouth to revise many of its existing business processes as part of the implementation of the UNITE student records system created an uncertain environment in which to attempt to implement the changes proposed by the SHELL project.

6.3 Learner Record

- The learner record piloted by the project is based on qualifications achieved and in progress. This provides the basis for the addition of PDP data by the PDP4Life project led by Bournemouth University.
- The University failed to transfer any test data to the pilot database.

6.4 Evaluation

Local evaluation of project deliverables

There were a number of deliverables for the SHELL Project. The evaluation strategy required that all deliverables were to be subject to acceptance testing by all members of the consortium in order to trigger payments to suppliers and partners. In addition to this, the strategy outlined a process for capturing formative feedback from partners to inform future development.

An [evaluation flowchart](#) set out the procedure to be followed. In essence, for each project deliverable (such as the learner record specification), a [Primary Evaluation Statement](#) was completed by the team leader responsible for that aspect. This statement, together with supporting evidence was passed to

the evaluation team. Each partner then completed a short [Local Review Statement](#) which offered institutions an opportunity to judge the deliverable in their own context.

During the course of the project, a range of approaches were taken in respect of this process.

Initially, a document management system was used to store electronic copies of evaluation statements and supporting evidence. This proved to be universally unpopular with the team due to the complexity of the system. A second approach involved bringing partners together for scheduled meetings, and this was more successful as it provided ring-fenced time for evaluation activities. However, the time taken for partners to travel between sites remained significant - for some, a meeting spanned a whole day when travel time was included. The most successful approach involved the development of a password restricted website, showing colour coded overall [evaluation progress](#) tables with straightforward instructions on 'what to do' for each deliverable. Links to summary pages showing [statements and evidence](#) were provided for each output. To simplify the review process, an [electronic review form](#) was developed and used to automate the procedure.

Although this took some time to establish, the simple and easy-to-use process proved to be very successful. Significant features of this approach include avoidance of the 'inbox full' problem with sending items by email, and the ability to quarry a single source of information for a range of purposes. This method is worth considering for longer term projects in particular, especially where there may be a turnover of team members over time.

Independent formative and summative evaluation

Independent project evaluation was undertaken by consultants at an interim and final stage. The interim project evaluation was designed to provide formative feedback to the project team, whilst the final project evaluation focused on a more summative judgement of success. Both of these reports are available via the project website.

6.5 Dissemination

The dissemination strategy outlined the range of communications with the local, regional and national/international community. This was approached in a range of ways:

- Initial 'Roadshow' presentations were developed and used as introductory sessions in the partnership. Although these attracted interest from those involved with partnership data, there was relatively little interest expressed by other areas of the community, notably academic colleagues.
- Briefing papers were produced and updated over the life of the project, circulated to project members and made available on the project website. These were also used as 'executive summaries' at project meetings and development events.
- An internal newsletter was developed, and used as an informal version of the briefing paper for use by project participants only.
- A 'project progress' update report was compiled by the BA&I team leader and sent on a regular basis to project participants showing delayed items in red. This proved to be an effective way of showing where bottlenecks and delays were – something that can be part buried in a large partnership.
- The project developed a short video setting out how the technical infrastructure worked, and showing what this meant for a fictitious learner called 'Susie'. This video received good acclaim, and we would urge other projects to consider the value of showing 'end goals' such as these as early as possible.
- Each team leader compiled a summary progress report and presented this at Board Meetings, where a regular slot was allocated for this purpose. This was judged to be an

effective way of communicating progress/issues at a senior level.

- The project team members attended a number of national and international events, (such as the JISC “Where worlds collide” event), producing project posters and information packs for this.
- Project team members attended other events and meetings with the specific role of presenting and discussing the intentions and progress within the project.
- The project team authored a number of papers, submitted and published in a range of conference proceedings. A full list is available via the project website.
- A small amount of funding has been allocated towards continuing dissemination, including a journal paper (submitted, under consideration for publication) and further conference papers. With the late development of the portal, we propose to take the final version into schools and colleges for feedback. The results of this will be submitted for publication.
- The website, developed as a resource of information about the SHELL project will be maintained and updated with any further dissemination activities such as those outlined above.

7 Conclusions

The concept of a lifelong learner record is powerful, potentially enabling learners to access a record of their development in the widest sense, irrespective of the life choices and pathways taken. Although limited to qualifications at present, the architecture developed by the SHELL project will facilitate the future storage of other records of achievement, such as personal development and planning. We believe the technical architecture developed by this project will enable all manner of legacy systems to be integrated to the potential benefit of lifelong learners.

Other projects are now commencing to take the idea of a lifelong learner record forward based on the start made by the SHELL project. Further projects might go on to consider how to make this record of lifelong learning inclusive, rather than exclusive. For example, relatively little work has been undertaken to investigate the implications for those possessing other qualifications (such as those gained overseas) that do not map to current schemas for learner record data. We would also suggest that a substantial further focus is needed on the issue of ‘what learners want’ from such a system.

Before a lifelong learner record could be considered to be successful, the shift from regional pilot to national facility is a significant divide that needs to be bridged.

8 Implications

The work of the SHELL project provides a basis for a number of further developments. Projects in some of the areas identified below could provide a valuable contribution.

Widening usage of the existing Learner Record

For a learner record to work well from a learner’s point of view, there would need to be a relatively high probability of being able to add to an existing record as learners move from institution to institution. A useful pilot could be achieved by introduction of the LR within a tight-knit group of institutions, perhaps using a single data controller with a national profile.

Widening the scope of the Learner Record

The PDP4Life project led by Bournemouth University is focussing on extending the existing learner record specification to include PDP data. This is an important next step which, in turn, should ideally lead to further development and piloting of the extended record.

Widening the scope of the Learner Record portal

Access by prospective employers would be a popular development with learners. Learners granting access to prospective employers could form the basis of income generation in the longer term and could be a strong driver for learners to become involved.

Technical Scalability

Extension of the index to the learner record database could pave the way to linking regional hubs together. This would allow learner records to be found as learners move from one regional pilot to another.

9. References

Project Summaries

- [1] “The SHELL Project”, Video Summary (January 2005) (www.shellproject.net)

Project Specifications and Agreements

- [11] [Learner Record Specification](#)
 [12] [Revised Business Processes](#)
 [13] [Administrative Portal Specification](#)
 [14] Data Processor Agreement
 [15] CSV Interface Specification
 [16] [Learner Record Web Site Specification](#)

ioNode

- [21] ioNode source (www.ioagent.org)
 [22] The SHELL infrastructure
 [23] The ioNode Test Bed
 [24] Download and installation of ioNode
 [25] ioNode Configuration
 [26] Developing a Transform
 [27] [Specification of Message Exchange with ioNode](#)
 [28] ioDB Web Services

Permissions

- [31] IPR agreement with Phosphorix
 [32] Agreement with ETL

Web sites

- [41] [Project web site](#)
 [42] [Learner record portal](#) (You can login via the account ‘**LearnerS**’ with password ‘**susie2**’ to simulate use by a learner. Please help others by not changing this password.)
 [43] [SHELL administrative portal](#) (The account ‘**college**’, password ‘**demo**’, simulates use by an administrator who can view data for simulated student registrations at Weymouth College. This can be used to find and display a test learner record for a student called ‘**Susie Learner**’ (consortium id **10400024**). You can also view the associated XML.)
 [44] [Testbed administrative portal](#) (with on-screen explanation of how to use)

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- [61] Yorke, J.D. (2002) [The JISC SHELL Project: connecting learning environments in higher and further education in the UK](#) (with associated [poster](#)). In: Proceedings of the ICCE Conference, New Zealand, 2002.
- [62] The JISC SHELL Project. In: 'When Worlds Collide', a JISC Infonet conference, United Kingdom, 2004.

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- [71] [Initial evaluation and dissemination strategy](#). August 2002
- [72] [Interim stage external evaluator's report](#). July 2003
- [73] [Glenaffric formative evaluation report](#). November 2003
- [74] [Final stage external evaluator's report](#). August 2005