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Manchester Metropolitan University

**Project name:** XCRI (eXchanging Course-Related Information)

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**Project Partners:** A complete list appears in Appendix A

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## ACKNOWLEDGEMENTS

As Project Manager I am extremely grateful to all who have given their time to make XCRI such a success (a full list of partners appears in Appendix A, but it is particularly important to acknowledge the work of Ben Ryan, Scott Wilson, Selwyn Lloyd, Julie Hardman, Alan Paull and Paul Walk). We are grateful to the JISC for having the confidence to fund a novel spin-off from Vashti Zarach's CETIS Enterprise SIG and for helping to create a supportive community of practice around the Reference Model projects. We also wish to acknowledge the excellent support of Manchester Metropolitan University, particularly Deputy Vice Chancellor Barry Plumb, Linda Scanlan and colleagues in the Finance Department.

## EXECUTIVE SUMMARY

This report summarises and evaluates output from the *eXchanging Curriculum-Related Information* (XCRI) project, which has received a total of 66,740 GBP from the JISC's E-Learning Programme under its E-Learning Framework Reference Models call. The project was managed by Dr Mark Stubbs of Manchester Metropolitan University as a virtual organisation of interested parties that included representatives from universities, colleges, CETIS and the University and Colleges Admissions Service (UCAS). The initial 12 month project began April 1, 2005 and was subsequently extended by 5 months.

A review of outputs confirms that XCRI achieved its stated aim of defining a vocabulary and appropriate (XML) technology bindings for describing course-related information that encompassed course marketing, course quality assurance, enrolment and reporting requirements. Outputs are documented on XCRI's presence within the E-Learning Framework website (<http://www.eframework.org/projects/xcri>), which now contains over 100 documents, including:

1. A project manager 'blog' explaining the thinking that has influenced project deliverables
2. A review of the suitability of Norway's CDM curriculum metadata approach for UK need
3. UK case studies and utilities for harvesting, converting and publishing curriculum content
4. An illustrative business case for adopting an integrated curriculum services approach
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15. XCRI Course Advertising Profile Schema with sample XML instances

Adoption of XCRI's initial R1.0 XML schema exceeded expectations. Highlights include:

- Reid Kerr FE College publishing an XCRI-compliant XML version of its prospectus catalogue in an afternoon
- Adam Smith College using an XCRI to PDF transform for course brochures
- The Learning Matrix Regional Pilot project using XCRI to aggregate learning opportunities offered by a range of providers in Liverpool
- APS consultants using XCRI XML for a database-to-database transfer of Plymouth University's course catalogue to UCAS
- Kainao.com developing an XCRI validator, Word 2003 transforms and web-based forms for capturing course information for the Pathways4Progression Regional Pilot project
- Oxford University Computing Services using XCRI to aggregate Continuous Professional Development short course information
- London Metropolitan University developing a prototype XCRI XML repository that supports XPath and XQuery web service searches, which was consumed by the Personal Learning Environment (PLE) Reference Model within 4 hours of being advertised

Critical reflection on these deployments produced an optimised Course Advertising Profile (CAP) schema. This schema was tested against existing R1.0 deployment and with a prototype aggregator that demonstrates the powerful potential of adding value to course information services (in this case through a Google Maps mashup).

XCRI is proud the JISC have shown sufficient confidence to commit 100K to funding national trials of the XCRI CAP schema and for developing the aggregator and supporting infrastructure. These outcomes represent important progress in XCRI's intended trajectory towards a national course information standard and demonstrate that JISC funding can be targeted effectively to support a virtual organisation in addressing a sector-identified problem that delivers outputs of significance for the whole UK FE and HE sector.

## INTRODUCTION

The aim of this document is to summarise and evaluate output from the JISC-funded XCRI (eXchanging Course-Related Information) Curriculum Reference Models project.

## BACKGROUND

The XCRI project received 66,740 GBP from the JISC's E-Learning Programme under its E-Learning Framework Reference Models call. It was funded from April 1, 2005, until September 30, 2006, and managed by Dr Mark Stubbs of Manchester Metropolitan University.

[http://www.jisc.ac.uk/index.cfm?name=elfref\\_mmu&src=alpha](http://www.jisc.ac.uk/index.cfm?name=elfref_mmu&src=alpha)

The JISC E-Learning Programme aims to facilitate lifelong learning, enhance the experience of learners and support a national agenda of widening participation. These goals are predicated on the availability of accurate and relevant information about opportunities for learners.

The need for appropriate course information has been emphasised in a number of influential reports on the UK further and higher education sector, including the National Committee of Inquiry into Higher Education (the Dearing Report), which stressed 'the importance of clear and explicit information for students so that they can make informed choices about their studies and the levels they are aiming to achieve'. The Report recommended 'that clear descriptions of programmes should be developed so that students are able to compare different offerings and make sensible choices about the programmes they wish to take'. The Committee also suggested that such programme specifications 'could usefully replace some of the prospectus material that is presently produced'. Institutions and aggregators in the UK are now responding to the challenge of supporting 'informed choice'. The central Universities and Colleges Admissions Service, UCAS, is working with institutions to communicate relevant information electronically to potential students in the form of course "entry profiles".

However, with the volume of study programmes offered and the range of disparate individuals who might usefully require or impart information about offerings, institutions face significant logistical, cultural and structural challenges in ensuring that programmes as they are advertised match programmes as they are approved and delivered. The goal is to provide definitive specifications that describe accurately the learning opportunities that will be offered in particular locations at particular times. Within the UK, the support and oversight of bodies like the Quality Assurance Agency and Qualifications and Curriculum Authority have encouraged universities and colleges to develop sophisticated and robust quality control procedures for scrutinising proposals for new or modified programmes and ensuring that only a catalogue of suitably validated programmes is offered. In the UK, information about the nature and scale of learner enrolment and achievement on these programmes underpins annual returns to sector funding bodies. A definitive catalogue of learning opportunities is therefore central to an FE or HE institution's marketing, quality assurance, enrolment and reporting activities.

The absence of standards for meeting the challenge of cataloguing and communicating learning opportunities was highlighted by Michael Aherne of Reid Kerr College in June 2004 at the sixth CETIS Enterprise SIG meeting<sup>1</sup>. Discussions with the CETIS Enterprise SIG led to a meeting at Manchester Metropolitan University in January 2005<sup>2</sup> where those attending agreed that:

- an open standards, service-oriented approach to managing and utilising course information was needed; and
- a bid to the JISC Reference Model call (closing the following week!) would be the best way to develop a suitable vocabulary and technology bindings and to demonstrate how such data could be managed, retrieved and transformed for different audiences using web services.

The Reference Model bid was accepted and the XCRI project began in April 2005 as a virtual organisation of interested parties that included representatives from universities, colleges, CETIS and the University and Colleges Admissions Service (UCAS), led by Dr Mark Stubbs of Manchester

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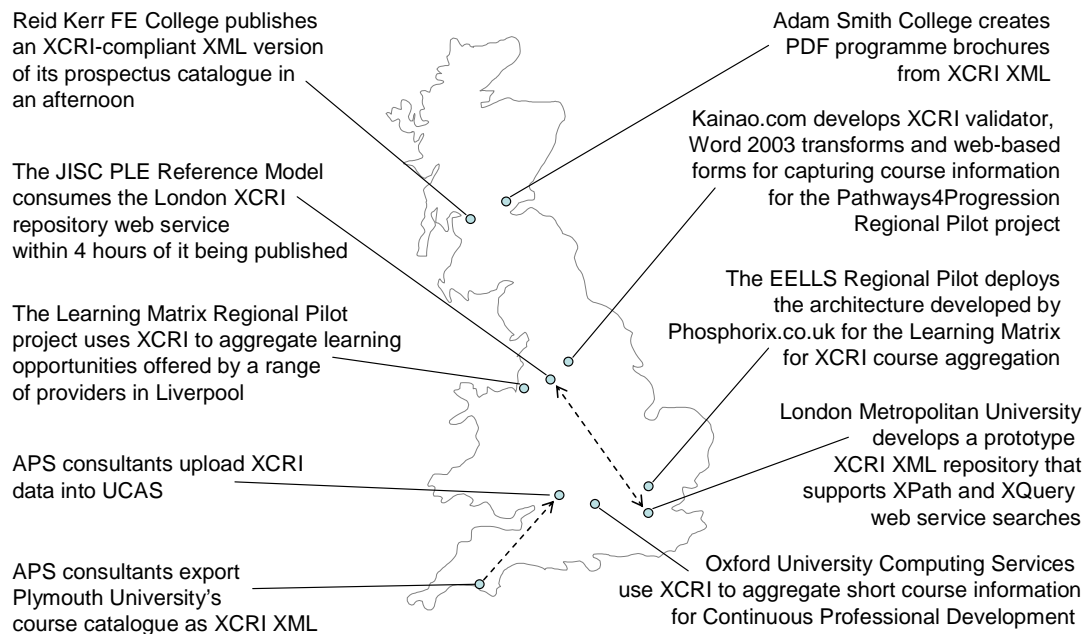
<sup>1</sup> <http://www.cetis.ac.uk/members/members/members/enterprise/members/enterprise/meetings/meetingsix>

<sup>2</sup> <http://www.elframework.org/projects/xcri/manchester1/view>

Metropolitan University. A full list of partners<sup>3</sup> and standards<sup>4</sup> influencing the project is available on the XCRI website.

## AIMS AND OBJECTIVES

The original XCRI project set itself the aim of defining a vocabulary and appropriate technology bindings (e.g. XML) for describing course-related information that encompassed course marketing, course quality assurance, enrolment and reporting requirements. The initial 12 month project produced an XML schema that met that aim and was piloted in institutions across the UK (see below). Extension funding was then sought to refine that schema and prepare the ground for its use in e-Admission.



For the duration of the project, XCRI has pursued its original aim of setting a standard that encompassed course marketing, course quality assurance, enrolment and reporting requirements, however investigations have revealed the domain space to be unevenly complex. With limited resources available, extension funding was targeted on Course Advertising as work in this area offers immediate and tangible benefits to course providers, learners and aggregator organisations.

Those responsible for course marketing often have to re-type course information extant in a structured database into web forms provided by different aggregator organisations. XCRI's survey of 161 online prospectus websites revealed variety in the presentation of information, which makes it difficult for prospective learners to compare offerings from different institutions (and in some cases to compare different courses from the same institution). Those involved in XCRI team are comfortable with the pragmatic decision to prioritise Course Advertising, and keen to stress a useful conceptualisation that ensures extension work on the specialist Course Advertising schema is coherent with XCRI's widely-tested R1.0 schema:

- Curriculum Management is about assembling fragments of relevant information covering all aspects of a course and its component modules (it is therefore best served by a relational model – the original XCRI R1.0 schema began to tackle these relations)

<sup>3</sup> <http://www.elframework.org/projects/xcri/#partners>

<sup>4</sup> <http://www.elframework.org/projects/xcri/#standards>

- Course Advertising is about a serialized export of a subset of the curriculum information that is of particular interest to those applying for courses (the XCRI Course Advertising Profile schema is optimised to support that serialized export).

## **METHODOLOGY AND IMPLEMENTATION**

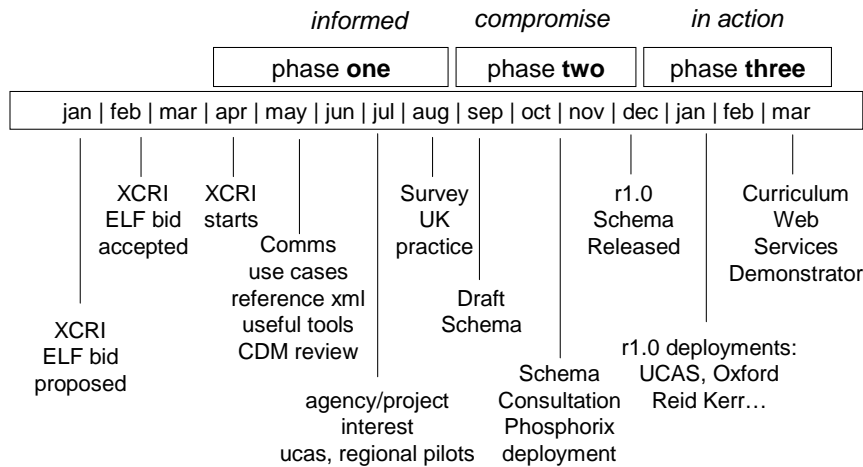
XCRI spun-out of the CETIS Enterprise SIG to tackle a problem that had been identified by that community: the lack of a standard for course information. The JISC's Reference Model funding enabled a virtual organisation to form that was coordinated by Dr Mark Stubbs of Manchester Metropolitan University. A light-touch variant of Prince 2 methodology was used to identify and schedule a series of work packages that defined a funding bid designed to buy-in the time and expertise of those well-placed to do the work. Email discussion, meetings timed to coincide with events that interested parties would be attending and an XCRI presence within the [elframework.org](http://elframework.org) site were the main instruments used to coordinate effort. A blog maintained regularly by the project manager kept everyone abreast of progress and was used to document the rationale behind all major design decisions.

The project adopted a strategy of: release early and respond to community feedback. Its aim was to produce a course information specification that was grounded in insights gathered from across the sector. Core members of the XCRI virtual organisation included those working in FE, HE and the UK's major course aggregator: the University and Colleges Admissions Service (UCAS).

The project was keen to avoid re-inventing the wheel if possible, and began by reviewing existing course information standards to assess their suitability for the UK context. The most promising in terms of maturity and level of adoption was the Norwegian CDM schema. However, detailed analysis evaluation by XCRI partners revealed that the following structural problems compromised its ability to fulfil UK needs:

- Specification and Offering were conflated, whereas UK practice was oriented around a Specification that was the focus of Quality Assurance processes and one or (more often) several Offerings that were the focus of Prospectus processes. For instance, an approved Specification might be offered many times or in multiple locations. It would be the Offerings that potential applicants would need to discover, which must be capable of inheriting quality-assured information contained within the Specification document.
- CDM enforced a hard-coded two-level hierarchy of Programmes and Courses (most closely mapped to Courses and Modules in the UK). Use-cases were identified that required more flexibility, for instance a concept of Stage, Level or Year between Courses and Modules that allowed for learning outcomes to be specified that would determine progression decisions at Examination Boards.

Other standards incorporated these features – for instance, eduCourse and the Swedish EMIL standard incorporated a notion of Specification and Offering - but these schemas lacked the range of expression necessary to realise XCRI's objectives of addressing quality, marketing, reporting and enrolment requirements. The project therefore decided to develop its own schema. This led to slippage against the original 12 month plan, but the flexible, virtual organisation structure of the project enabled activity to be reorganised sufficiently quickly to stay within its planned phases of: informed, compromise, in action (see below).



Having made the decision to develop its own schema, XCRI commissioned a detailed survey of UK online prospectus content to get a clear idea of what institutions wished to communicate. This survey informed an iterative process of schema design and testing with sample instances from varied institutions. The schema prototyping process was aided immensely by the willingness of Phosphorix to test iterations within its regional portal work. These iterations led to the R1.0 schema released in December 2005 that was subsequently tested in 2006 (see earlier map of deployments) and used as the basis of a Curriculum Web Services Demonstrator.

Extension funding enabled a critical review of XCRI's original R1.0 schema and the uses to which it was put. This review was supported by reflection on the information needs arising from the course lifecycle from design and validation through to inevitable modifications. This review concluded that the original R1.0 schema was making too much of a compromise between the relational requirements of curriculum management and the serialized export needed for course advertising. XCRI concluded that effort needed to split into two so that work could progress on the unique requirements for each. The XCRI team decided to document insights learned so far on curriculum management and concentrate on developing an optimised Course Advertising Profile (CAP) schema that would be capable of supporting the JISC's e-Admissions agenda. The CAP schema was tested for coverage and simplicity against all existing XCRI R1.0 deployments and released in August 2006 with sample XML instances. XCRI CAP can now move forward to national trials with the JISC making 100K available to support 8-10 institutions, and additional funding to support a demonstration aggregator and a supporting website with Wiki and issue-tracking features.

## OUTPUTS AND RESULTS

The E-Learning Framework website has been used to communicate project progress and findings (<http://www.elframework.org/projects/xcri>). The site now contains over 100 documents, including:

1. A project manager 'blog' explaining the thinking that has influenced project deliverables
2. A review of the suitability of Norway's CDM curriculum metadata approach for UK need
3. UK case studies and utilities for harvesting, converting and publishing curriculum content
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### ***Project Manager Blog***

The [www.elframework.org](http://www.elframework.org) site included a blog tool. With the virtual organization structure of the project, this proved an invaluable tool for documenting and communicating decisions that were influencing project direction. This had a two-fold effect of providing publicity and being able to point interested parties to a documented rationale for design decisions in the emerging course information space. Over 25 postings were made in the course of the project. Most provided a synthesis of insights gained from meetings and conversations and each of these was confirmed as a fair record before it was posted. Those involved in XCRI were geographically distant and the blog was used a focal point to communicate a sense of a project moving forward to sustain interest and involvement.

### ***Review of the Suitability of Norway's CDM***

Without exception, XCRI partners expressed admiration for the work undertaken by the CDM team. The schema, and its particular attention to the European Credit Transfer Scheme (ECTS), ensured that a home could be found for most information that needed to be stored. Respondents were keen to build on the CDM work and raised a number of problems and suggestions for a closer fit to UK need:

- Several institutions (including UCAS) identified a need to distinguish between course Specification and Offering.
- CDM's hard split between Programme and Course didn't suit all institutions: many used different names, others had curriculum objects in-between that needed to be represented (eg Programme hasMany Courses hasMany Stages hasMany Units/Modules). Several contributors suggested that Programme and Course should perhaps be modelled as implementations of a more generic curriculum Specification object.
- Several institutions described how rules for curriculum structure (cores, options, 4 mandatory plus 1 from Set A plus 1 from Set B, etc) were often specified in UK definitive documents and needed for enrolment purposes, but didn't seem to be captured in a way that was amenable to automated processing. It was also noted that rules would be required to alert students to typical pathways: recommendedFollowOn, etc.
- Many respondents suggested that infoBlockType could probably be handled with XHTML
- Varied requirements (mainly for searching and reporting purposes) were expressed for identifying Programmes, Courses, Units or Modules against many different coding schemes. It was apparent that a precise but flexible identifier and typing approach would be needed for the UK, which would work for schemes administered by local institutions and national bodies, such as the QAA, UCAS and HESA.
- One institution raised the problem of versioning Specifications, particularly for courses in transition. For instance, in the same academic year, a two year programme might have its first year following a recently-approved Specification, while its second year was still on the old scheme. A system that provided students with definitive information about their course would need to reference the correct Specification for each year group.
- Two institutions identified their need to express multiple accreditations for different bodies. Details of the accreditation date, and a description and any qualifications upon the accreditation would need to be stored for each body

XCRI decided to develop its own schema and to feed back its work and ideas to CDM and efforts to harmonize it with Swedish and Finnish initiatives. Work continues in Scandinavia in this area – a draft of the Finnish model has just been released – and it is hoped that XCRI extension work will facilitate ongoing dialogue, potentially through links with the TENCompetence project.

### ***UK case studies and utilities for harvesting, converting and publishing curriculum content***

XCRI reviewed work on maintaining and transforming curriculum content and identified three main approaches<sup>5</sup>:

- Online entry into a back-end database – student records vendors, such as Distinction Systems Ltd, are now offering web-based Curriculum Management Systems that surround online database forms with quality assurance workflow functionality for the creation, management and approval of courses and modules. The XCRI website provides a review of Nottingham Trent's custom-developed system.
- Using styles in Microsoft Word to separate otherwise monolithic document into distinct sections that can then be extracted and stored. The XCRI website offers an open source

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<sup>5</sup> <http://www.elframework.org/projects/xcri/conversion>

download of Java code developed at London Metropolitan University for parsing module information tagged using Word styles.

- Using Microsoft InfoPath forms to enter and validate content directly. The XCRI website documents how Adam Smith College in Fife used this approach to meet their Marketing Department's requirement for a single editable source that could be converted for web and printed prospectus. The case study includes sample InfoPath forms.

### ***An illustrative business case for adopting an integrated curriculum services approach***

The XCRI website includes a simple Javascript question and answer form<sup>6</sup> designed to prompt users to consider the strength of the business case for adopting an XCRI-style approach to curriculum management.

### ***A survey of 160+ UK online prospectus entries used to critique candidate schema elements***

XCRI was keen to validate the list of candidate XML schema elements that had emerged during interviews, document analysis and site visits. Doctoral researcher, Julie Hardman of Manchester Metropolitan University, was employed to review the emergent schema elements against recurrent material in online prospectus websites. Julie's review of 161 sites is available for download from the XCRI website<sup>7</sup>. It noted that:

- UK HEIs and FECs feel obliged to provide prospective students with more course-related information online than just a list of course titles or a link to download hard copy information. A wealth of information about UK further and higher education courses is already available online.
- the majority of UK institutions appear to draw course-related information from multiple sources. Discrepancies between course information presented in different parts of an institution's online presence are common but this largely manifests as differences in wording - anything more is confusing to prospective students.
- most UK HEIs and FECs use a standard template for the information they display to their audience although this often breaks down when a prospective student 'drills down' for more detail. HEIs often present undergraduate and postgraduate course information differently.
- although the sample of FECs was relatively small, FEC course presence tends to be more consistent and tightly integrated than HEI equivalents. HEIs are more likely to repeat course information as a centrally-coordinated HEI online presence is often supplemented with additional information from faculty / school / course websites.

Detailed review of the categories identified in the prospectus content survey provided the basis for the R1.0 schema and the optimised CAP schema.

### ***Draft and Release 1.0 XML Schema documents with sample XML for each***

Feedback on a consultation draft of the XML schema was collected between October and November 2005<sup>8</sup>. The schema was released with comments and sample XML document, which enabled open source software developers Phosphorix to deploy the pre-release schema in the Liverpool Learning Matrix Regional Pilot project. Experience from this deployment and 40 specific comments on the draft schema led to Release 1.0 of the schema being published in December 2005<sup>9</sup>.

Release 1.0 was also informed by a joint information modelling workshop involving the XCRI, COVARM, Pathways4Progression and the SUNIWE projects. This workshop concluded that:

- Curriculum is an all-embracing term – exchanging course-related information prioritises an interest in fragments of curriculum: module specifications, learning outcomes, assessments, teaching and learning strategies, etc.
- Linkages between curriculum fragments are important to capture: which learning outcomes are assessed by which fragments, which learning outcomes flow from which subject benchmarks, which modules make up which stage of which course, etc.
- An important distinction must be maintained between specification and offering of a course
- Definitive course information often makes reference to associated organisations: accrediting bodies, awarding bodies, franchise partners, etc.

<sup>6</sup> <http://www.elframework.org/projects/xcri/businesscase>

<sup>7</sup> [http://www.elframework.org/projects/xcri/xcri\\_research\\_v0c.doc](http://www.elframework.org/projects/xcri/xcri_research_v0c.doc)

<sup>8</sup> [http://www.elframework.org/projects/xcri/xsd\\_consult](http://www.elframework.org/projects/xcri/xsd_consult)

<sup>9</sup> <http://www.elframework.org/projects/xcri/20051222Manchester>

- Ideally, recognition awarded for completing fragments of curriculum (eg courses and modules) should be represented in the same way as entry requirements, although work to harmonise transcript, e-Portfolio and course modules and establish and maintain vocabularies to aid interoperability (within the UK and internationally) will be a major project.

The R1.0 schema supports the required distinction between Specification and Offering, enables a recursive assembly of Specifications and allows linkages to be specified between different fragments of curriculum. In order to address quality assurance, marketing, enrolment and reporting requirements there are many optional elements, which make the schema quite large. Sample XML was provided with the R1.0 schema although time pressures meant it lacked comments. Extension funding enabled a full review in the light of deployment experience, which resulted in the XCRI CAP schema.

### ***A series of case studies of XCRI XML deployment from across the UK***

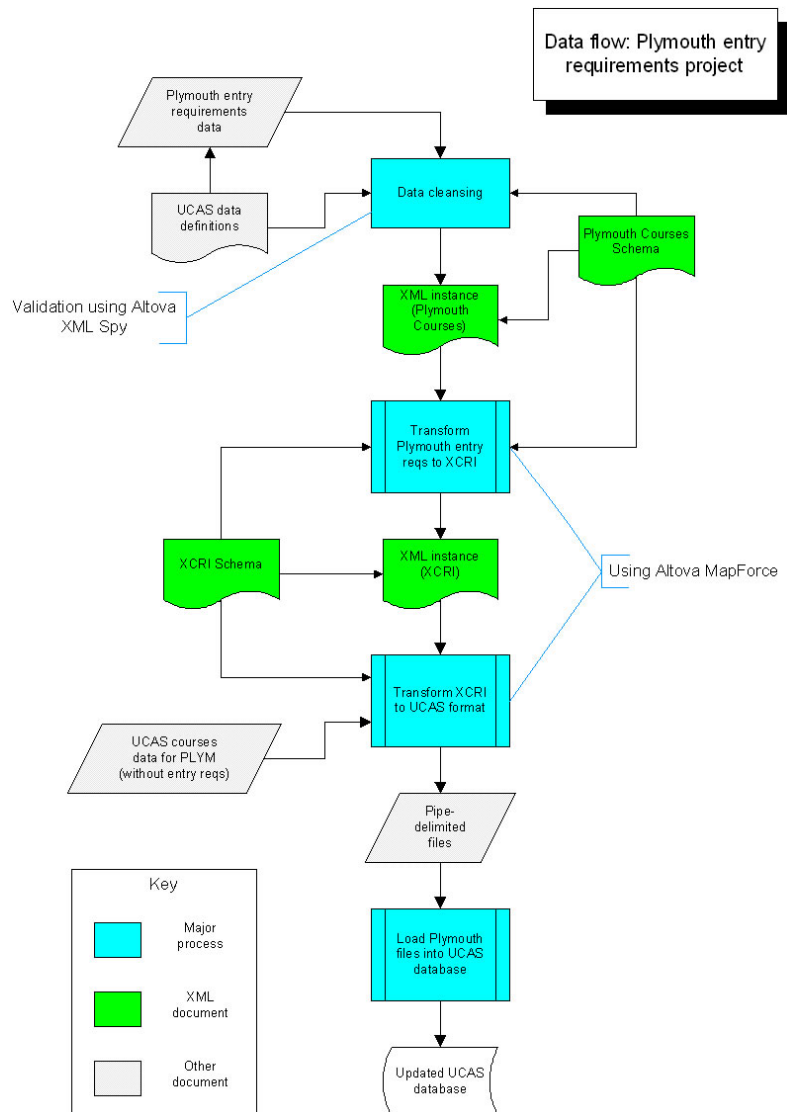
XCRI R1.0 has been involved in a number of deployments across the UK:

- Exeter-based software company software company, Phosphorix, deployed XCRI draft XML to support two JISC-funded Regional Pilots: the Liverpool Learning Matrix and East of England Lifelong Learning System. Phosphorix followed an extreme programming philosophy in which they decoupled development from the XML, starting first with a “noddy course XML” and gradually increasing sophistication as the XCRI XML standard became more mature. Details of their software and approach can be downloaded from the XCRI website<sup>10</sup>.
- UCAS and the University of Plymouth wanted to facilitate the database-to-database transfer of courses data for course entry requirements, in preference to re-keying the data using the UCAS Web-link facility (formerly Netupdate). UCAS wish to develop a long-term solution for exchanging courses data with member institutions, alongside existing methods for exchanging data about applicants. Experienced consultant, Alan Paull of APS, used the XCRI schema to facilitate this data transfer. Details of the case study can be downloaded from the XCRI website<sup>11</sup>, but the diagram below gives an overview of the approach used.

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<sup>10</sup> <http://www.elframework.org/projects/xcri/20060130Manchester#phosphorix>

<sup>11</sup> <http://www.elframework.org/projects/xcri/PlymouthUCASCaseStudy.doc>



- Scottish, Further Education College Reid Kerr extended the Microsoft Active Server Page solution used to populate their online course prospectus to include XCRI-compliant XML in only an afternoon. Reid Kerr's web developer, Michael Aherne, had originally highlighted the absence of course information standards to colleagues on the CETIS Enterprise SIG and with the release of R1.0 of the schema he set himself an acid test for schema adoption: how long would it take a lone developer to make an existing prospectus XCRI compliant? After getting to grips with the schema, he found that he was able to complete the task in 2 hours. Full details of his case study can be downloaded<sup>12</sup>.
- Oxford University Computing Services used the XCRI schema to publish details of their short course offerings for aggregation in a Continuous Professional Development (CPD) system. The developers had not been involved in the original XCRI partnership and had worked solely from documentation available on the XCRI website. Their skill and the XML document examples released with the R1.0 schema enabled them to build the system successfully despite the lack of comments in the complex schema. Valuable experience gained from their deployment will feed into R1.1.

<sup>12</sup> <http://www.elframework.org/projects/xcri/20060130Manchester#reidkerr>

- Manchester Metropolitan University is currently reviewing the template used for its Programme and Module specification documents. A XSLT is available for download<sup>13</sup> that transforms XCRI XML into XHTML to illustrate the proposed template structure.
- Tavis Reddick of the Adam Smith College in Fife (Scotland's third largest), used XCRI to develop the College's Marketing Information and Publishing systems. The case study on the website<sup>14</sup> provides example XML and XSL used to produce PDF course brochures.

### ***Links to a web service demonstrator for uploading to and querying an XCRI repository***

XCRI had intended from the outset to specify curriculum service operations and implement them as web services. An email exchange summarised on the XCRI blog<sup>15</sup> led to a change of direction. XCRI partners had been interested in the possibilities afforded by an XML database for storing and querying curriculum data. Investigation of systems built on such technology revealed an interesting approach pioneered by Kimbro Staken<sup>16</sup> for creating light weight web services that incorporated XPath queries in the URL. XCRI decided to postpone WSDL development and prototype this light weight ReST-style approach instead.

Paul Walk, Senior Web Services Developer at London Metropolitan University (now of UKLON), was commissioned to develop the demonstrator using Java Servlet technology on top of a BerkeleyDB XML database from Sleepycat software (recently acquired by Oracle). A WebDAV interface was built to allow XCRI XML documents to be uploaded into a holding area from which they could be imported into the XML repository. During the import, documents are validated against the XML schema with only valid entries being accepted. Java Servlets provide XQuery and ReST access to XCRI document fragments (XCRI:any) from the repository:

The ReST interface offers a novel XPath URL that returns requested content:

`http://server:8080/xcri/curriculum/spec[identifier="5A2070"]`

This URL would return any curriculum specification node tree with an identifier of 5A2070.

The Servlet follows ReST protocol in returning an HTTP/1.1-compliant header:

200 if the search returns matching XML

404 if the search returns no matching XML

The genesis of this approach is described in an XCRI blog entry:

<http://www.elframework.org/projects/xcri/20051111Manchester>

The XCRI team have been impressed by the possibilities for light-weight systems integration afforded by this approach, for instance in presenting to interested consumer systems just the learning outcomes of a particular study module, or the entry requirements for a particular course. This has the potential to enable rapid interconnection of definitive curriculum repository content with e-Portfolio and personal development planning systems.

### ***Links to the source code and UML documentation for the web service demonstrator***

All code developed for the XCRI web service is available for download from the XCRI web site. A zipped distribution is available<sup>17</sup> with links to a TiddlyWiki site<sup>18</sup> carrying full Javadoc and UML documentation (extracts below).

<sup>13</sup> [http://www.elframework.org/projects/xcri/mmu\\_ps.xsl/view](http://www.elframework.org/projects/xcri/mmu_ps.xsl/view)

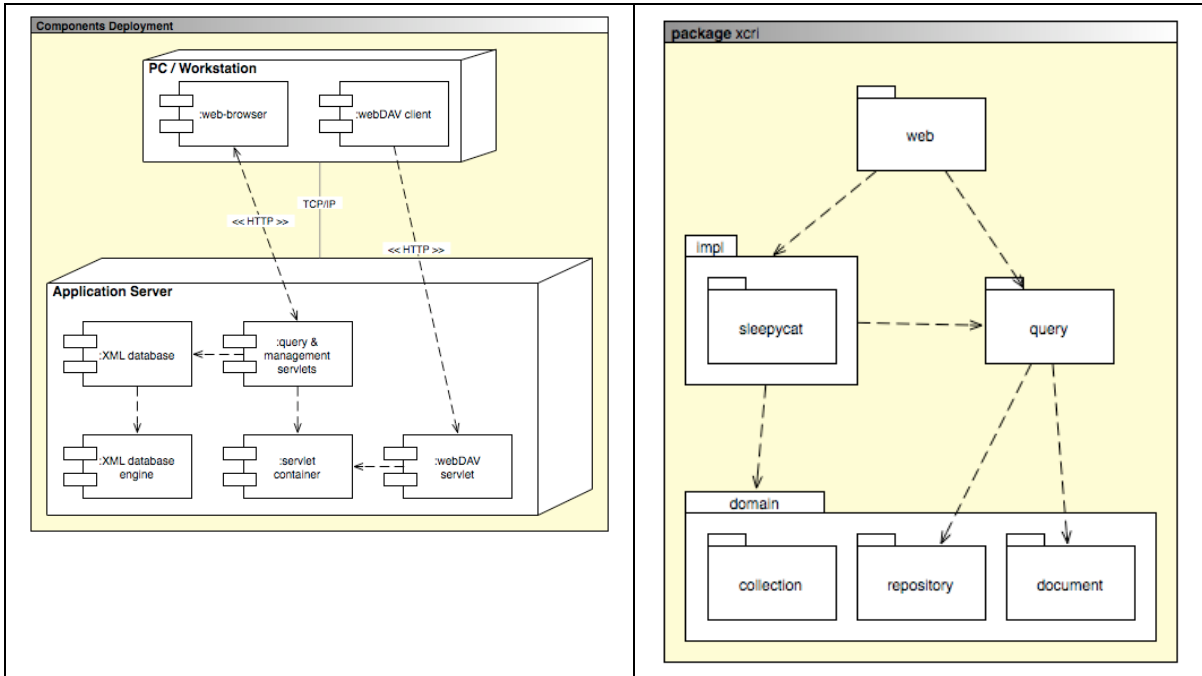
<sup>14</sup> <http://www.elframework.org/projects/xcri/20060509Birmingham#fife>

<sup>15</sup> <http://www.elframework.org/projects/xcri/20051111Manchester>

<sup>16</sup> <http://www.xmldatabases.org/WK/blog/262?t=item>

<sup>17</sup> <http://www.elframework.org/projects/xcri/xcri.zip/view>

<sup>18</sup> <http://portal.londonmet.ac.uk/xcriDocs/docs/>



### ***XCRI transformation web services***

Phosphorix's pioneering work with early releases of the XCRi schema for regional portals identified the need for simple prospectus feeds from partner colleges. Most colleges lacked an IT development capability that was comfortable working with web services, so Phosphorix developed the idea an agent that would take simple, Comma-Separated-Values-style input, and transform it to create XCRi XML for feeding a portal. This transformation was named: ioMorph. XCRi extension funding enabled this service to be extended for use with the XCRi Course Advertising Profile Schema. A sample installation is available at:

<http://lmxdev2.ionetwork.ac.uk:8180/ioMorph2WSClient/sampleIOmorph2PostProxy/TestClient.jsp>

The sample installation exposes 4 methods:

- `getEndpoint()`
- `setEndpoint(java.lang.String)`
- `getIOmorph2Post()`
- `ioMorphWSTransform(java.lang.String, java.lang.String, java.lang.String, java.lang.String, java.lang.String)`

It can be demonstrated by:

1. calling `setEndpoint` with:
 

<http://lmxdev2.ionetwork.ac.uk:8180/ioMorph2WS/services/IOmorph2Post>
2. calling `ioMorphWSTransform` with:
  - Transform – as the first string (the operation type)
  - course-info2 – as the second string (the type of transformation)
  - a plain text string of name-values to be transformed as the third string - formatted according to a naming convention that identifies the element to be populated and the values to be used. The following extract would populate the provider organisation's address elements in the XCRi CAP:

[providerorganisation.provideraddress (address)

Values  
(The Adam Smith College'),

```
('St Brycedale Campus'),  
( 'St Brycedale Avenue'),  
( 'Kirkcaldy'),  
( 'Fife')  
]
```

- xcri-cap.xml – as the fourth string (the name of the stylesheet to apply)
- blank – as the fifth string (an output stylesheet if performing XML to XML transformation)

The ioMorph webservice then returns correctly-formatted, XCRI CAP XML for the course information supplied.

For those keen to participate in this open source development, demonstration clients, the ioMorph code for the transform, installation and Javadoc documentation, are available at:

<http://iomorph.ionetwork.ac.uk/website/>

### ***Requirements for an XCRI structured authoring tool***

The need for a tool to author curriculum content was identified in requirements analysis work undertaken under XCRI's original funding. Extension funding enabled the requirements for such a tool to be articulated more fully, and Ian Martin, XML and web applications specialist at the Open University (OU), was commissioned to investigate the area of "structured authoring tools". Ian's report explores requirements for navigation, assistance with document validity, online and offline editing, use of templates and links to existing repository content. A round-up of available technology includes consideration of the relative merits of tools such as text editors, EMACS, Eclipse with the XML Buddy plug-in, and approaches based on XFORMS and Microsoft's InfoPath. The OU's approach to structured authoring is highlighted, and comparative tests performed on editing an OU course using a plain text editor, an XML-aware editor, a word processor - Microsoft Word and a dedicated XML editor (e.g. Altova's XML Spy). The report reveals current authoring options to be relatively immature, and highlights that a good tool is likely to assist in the structuring of content and support the process of linking to content elsewhere – something which requires either online connectivity or smart caching technology to support offline working (perhaps using something like Scrybe<sup>19</sup>).

### ***Report on competence modelling and XCRI***

As part of its extension funding, XCRI was keen to explore the links between course information and representations of acquired and required competence that could facilitate identification of individual pathways to a learner. A report from Simon Grant (CETIS e-Portfolio SIG coordinator) was commissioned<sup>20</sup>, which concluded that:

- The area of competence representation was complex and a long way from being mature
- HR-XML includes a useful spec for representing competency in human-readable terms, but would need to be profiled before it could provide an effective basis for automatic processing of course entry requirements and a learner's previous achievements.
- A Web 2.0-style approach could usefully extend RCD<sup>21</sup> to enable communities to specify competence equivalents, which would be important for matching learners' achievements against entry requirements in a diverse educational arena

Work from the HR-XML on web services for sharing training course information with systems designed to manage employee training and professional development<sup>22</sup> will definitely be worth watching as the area matures.

---

<sup>19</sup> <http://www.youtube.com/watch?v=1u3ekzwnYxw&e>

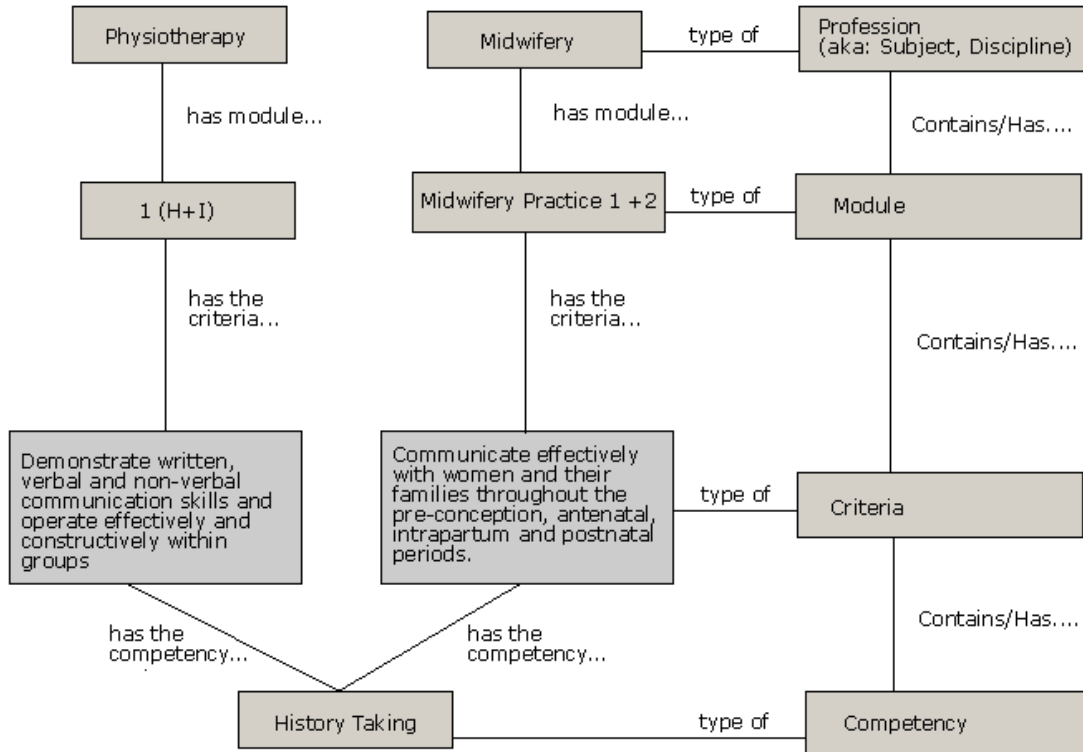
<sup>20</sup> [http://www.elframework.org/projects/xcri/XCRI\\_competencies.doc](http://www.elframework.org/projects/xcri/XCRI_competencies.doc)

<sup>21</sup> Reusable Competency Definitions <http://ltsc.ieee.org/wg20/>

<sup>22</sup> <http://www.elframework.org/projects/xcri/20060717Manchester>

**Report on curriculum mapping for medicine**

XCRI has always been keen that its curriculum modelling work is grounded in real-world examples. Courses linked to professions with well-articulated competence maps are generally regarded as those most likely, in the first instance, to pursue and gain benefit from mapping their curriculum against intended acquired competence. XCRI therefore commissioned Scott Hennessy to explore the rationale for mapping Leeds School of Medicine’s curriculum against competencies defined in the General Medical Council’s “Tomorrows Doctors” scheme<sup>23</sup>. Scott’s report<sup>24</sup> identified key benefits of curriculum mapping as: structuring learners’ portfolios in terms of professional requirements and assisting curriculum managers in reviewing coverage and assessment of learning outcomes. He identified particular challenges posed by semantics and specificity of competencies and highlighted the potential of ISO 13250 Topic Mapping for managing and providing navigability for mappings:



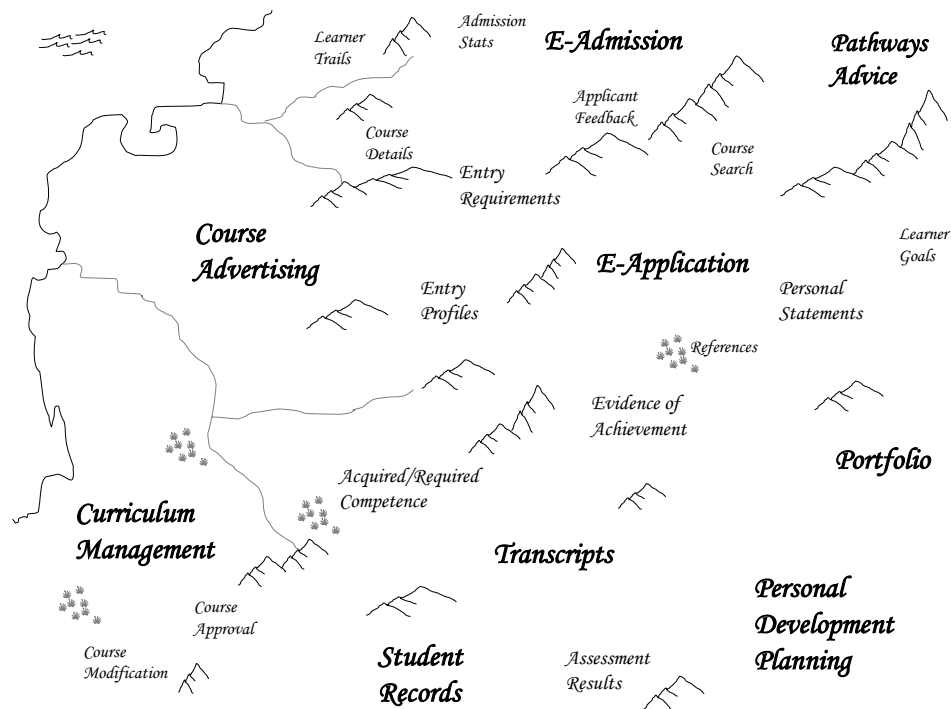
**Lessons about curriculum modelling**

Work is still required to articulate fully a course information model, but understanding has developed significantly through joint modelling sessions with the COVARM course validation reference model, and has been refined further in XCRI’s extension phase to the following high-level working model:

<sup>23</sup> [http://www.gmc-uk.org/education/undergraduate/tomorrows\\_doctors.asp](http://www.gmc-uk.org/education/undergraduate/tomorrows_doctors.asp)

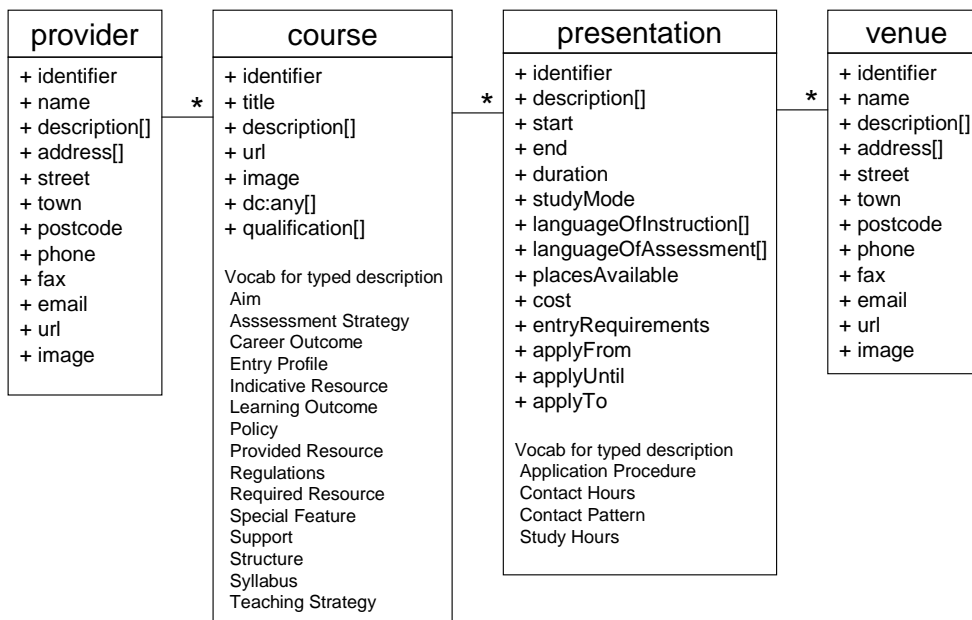
<sup>24</sup> [http://www.elframework.org/projects/xcri/Mapping the Leeds School of Medicine Curriculum.doc](http://www.elframework.org/projects/xcri/Mapping%20the%20Leeds%20School%20of%20Medicine%20Curriculum.doc)





### XCRI Course Advertising Profile (CAP) Schema

The XCRI CAP schema has been derived from critical reflection on XCRI R1.0 deployments and on the requirements for course advertising revealed in the survey of 160+ UK online prospectus sites. The structure of the CAP is as follows:



XCRI CAP structure:

- A provider can offer many courses
- A course can have many presentations (specific instances of the course to which students can apply)

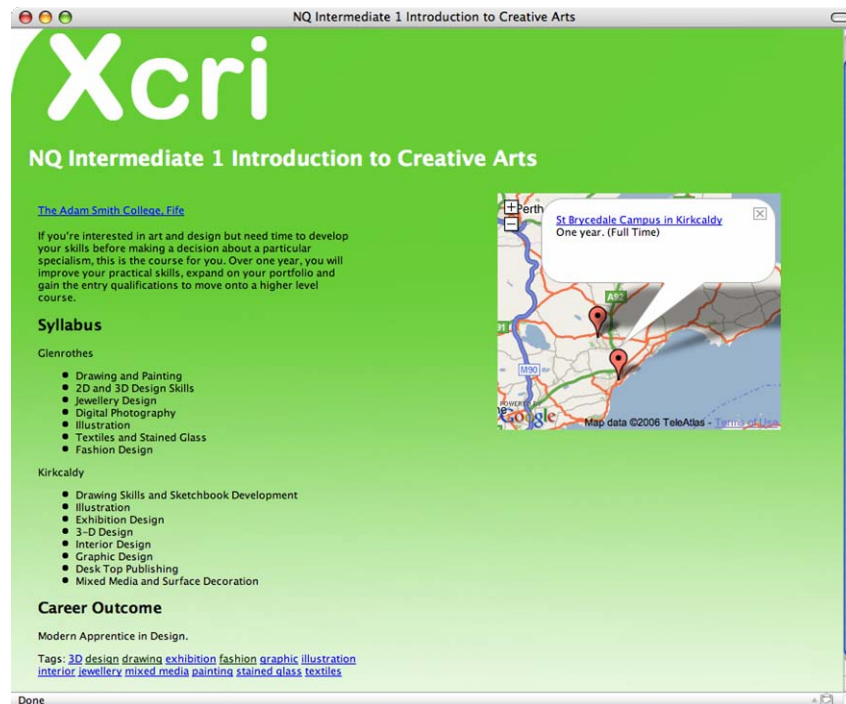
- A presentation may use one or more venues

Experience from ‘light-weight integration’ between XCRI’s curriculum repository webservice and the PLEX Personal Learning Environment, led to the use of a description element, which could be typed according to a defined vocabulary to indicate description of particular relevance for a course or presentation. It is anticipated that this vocabulary will be refined through forthcoming national trials but it is hoped that “typed description” will provide the right balance between flexibility and structure to maximise the utility of course descriptions for prospective learners. For instance, it should be possible for a user to ask for two courses to be compared side-by-side with descriptive content for each of the various sections organised for ease of comparison in the same kind of way in which a buyer might compare two flat screen televisions to see whether a Freeview receiver was built in, how many SCART sockets they offered, and whether they had HDMI inputs, etc.

Critical reflection on the R1.0 schema led to a minimalist approach for the CAP XML. Re-use of elements from the Managing Information Across Partners’ (MIAP<sup>25</sup>) Common Data Definitions (CDD) schema suite was considered at length when designing the XCRI CAP.

Comparison of MIAP CDD against requirements identified in XCRI’s survey of 161 prospectus websites, confirmed that it lacked the coverage necessary to be profiled for course advertising.

Address structures within MIAP CDD were considered for XCRI CAP, but rejected on the grounds that their levels of precision made them un-necessarily verbose. To validate this decision and confirm fitness-for-purpose of levels of address precision available in the XCRI CAP schema, Scott Wilson developed a prototype aggregator that used a Google Maps mashup to display venues where a course would be presented (see below). This confirmed that the CAP’s minimalist XML had not compromised its power of expression and potential for informing the prospective learner.



## OUTCOMES

XCRI was constructed as a Reference Model project at short notice in response to a shared need for a course information standard identified by the CETIS Enterprise SIG. It set out with the intention of

<sup>25</sup> <http://www.miap.gov.uk/commondatadeclarations.htm>

tripling the Norwegian CDM course information metadata standard. Lack of inertia within the project structure – XCRI was basically a two-day per week project management backbone with funds for commissioned work – enabled it to switch quickly to developing its own course information specification. This was only possible because of its links to the CETIS Enterprise community and its determined networking with other JISC projects – most notably the close working relationship established with Ben Ryan of the Pathways4Progression Regional Pilot, which brought years of schema design expertise into XCRI. The agile, virtual-organization nature of the project was sustained through the determined efforts of the project manager – regular emails and phone calls to parties whose expertise or contacts were needed at particular times (eg Scott Wilson, Phosphorix, APS Consulting), and an emphasis on documenting progress regularly via the project website, which enabled everyone to share the sense of a project moving forward through community engagement.

It is clear from Programme meetings that the Reference Model projects followed different approaches to one another. When reflecting upon this Programme and the broader goals of developing the e-Framework, it will be interesting to contrast XCRI and COVARM (with which XCRI worked closely). COVARM enjoyed a wealth of UML modelling expertise and followed a rigorous Model-Driven Approach from high level business processes through to low level workflow service implementations. XCRI's limited resources meant that it adopted a more pragmatic but nonetheless grounded, data-driven approach: prototype XML documents and schemas were developed from interviews, site visits, document reviews and a major survey of over 160 online prospectus web sites. The prototype XML documents were used as a focus for community review and critique. These early deliverables were sufficiently tangible for developers to begin building with and experience from real deployments then fed back into the evolution of the XML schema. Inevitably, limited resources meant that corners were cut. Release 1.0 of the schema was published with illustrative XML documents, but without any accompanying documentation or even comments within the schema. Even in this raw form, it proved sufficient for developers within Oxford University's Computing Services to aggregate details of CPD training courses, but this achievement is testament more to their skill than the intuitive nature of the schema. XCRI's lack of documentation and formal models is symptomatic of its limited staff resource, which was deliberately deployed differently to COVARM with the emphasis firmly on iterative development to break new ground and build high levels of community adoption and interest. For pursuing new areas the XCRI approach has considerable merit, but it seems apparent that it must adapt to become more rigorous as appreciation of the domain matures and specifications near production.

XCRI's extension funding enabled it to reflect critically on the R1.0 schema it had developed and led to the realisation that the immediate community need was for a schema optimised for Course Advertising. The R1.0 schema, and work that accompanied it, represents significant progress in understanding of the Curriculum Management domain, and it is hoped that this can be built upon in subsequent JISC-funded activity.

Bill Olivier's aspirations for the Reference Model projects were that they would:

- Co-evolve software and practice
- Deliver benefits for the whole FE/HE community
- Building shared understanding in a particular domain of e-learning and e-admin
- Develop a knowledge base of materials to inform future work
- Facilitate lightweight, quick-win developments

XCRI's outputs have made real progress against each of those goals.

Earlier sections have demonstrated the wealth of domain knowledge that has been documented through project activity. XCRI's trajectory towards setting a UK standard for course information is continuing beyond the scheduled end of the project with JISC-funded national trials of the CAP schema together with a demonstration aggregator and support site. These outputs are remarkable from a 67K total investment and testimony to the hard efforts of a geographically-dispersed community of talented individuals.

## CONCLUSIONS

Diversity within the JISC Reference Model Projects community has been a source of learning for all concerned, and whilst intentions of submitting the work of the Reference Model projects to the e-Framework may not have been achieved within the timeframe of the programme, it is without question that the Reference Models have built capacity in the practical implications of realising Service-Oriented approaches and produced some important knowledge bases from which others can draw.

XCRI's 17 months of project activity have led to a number of important lessons:

- An agile virtual organisation coordinated by an active website can be a good way to develop understanding of a new domain area
- Course Advertising and Curriculum Management are two related areas of real interest to the UK Further and Higher Education sectors
- Light-weight XML standards and web-services can be prototyped and adopted very quickly if they are designed to support an area where there is real need for electronic support
- The course entry process can be assisted electronically in various ways – making sure prospective students are well-informed is likely to bring more immediate gains than tackling the significant challenges raised by automated matching of learner achievements against course entry requirements

Perhaps the main conclusion from this project is that Reference Model might not be the best description of the activity, but XCRI has demonstrated that JISC funding can be targeted effectively to support a virtual organisation in addressing a sector-identified problem that delivers outputs of significance for the whole UK FE and HE sector.

## IMPLICATIONS

If XCRI continues on its current trajectory and is adopted as a national standard for course advertising, the key beneficiaries will be:

- Prospective learners who will be able to access and compare course offerings more readily
- Those responsible for course advertising, who will find it much easier to submit prospectus content to specialist course aggregator sites and regional portals
- Student records system vendors who will have a clear specification to work to when developing their products to meet institutional requirements

XCRI activity has opened up several avenues for future development:

- Continuing XCRI CAP's trajectory towards a UK standard for course advertising and engaging with European partners on opportunities for wider information exchange
- Building on the Curriculum Management modelling work to articulate an information model and key services to support the course life-cycle and its interactions with e-Admission and e-Application
- Building on ideas about annotating the curriculum with competence information raised in work commissioned by XCRI
- Developing the XPath ReST URL idea piloted with XCRI's Curriculum Repository as a flexible interface to XML data stores

The JISC is already funding the first of these, and has funds available for the second under the same call if a bid were suitably constructed. The third and fourth are likely to be of interest to the e-Portfolio and Repository communities, respectively.

## **APPENDIX A: XCRI PARTNERS**

XCRI has only been possible through the combined efforts of its virtual team. Support from institutional partners has been outstanding:

The Adam Smith College – Tavis Reddick  
Bolton University – Scott Wilson  
Leeds University – Scott Hennessy  
Liverpool John Moores University – Derek Hendy  
Liverpool University – Roger Clark  
London Metropolitan University – Paul Walk (now UKOLN)  
Manchester Metropolitan University – Julie Hardman  
Open University – Ian Martin  
Oxford University – Adam Marshall, Alys Morgan & Keith Lewis  
Staffordshire University – Mark Stiles  
Reid Kerr College – Michael Aherne  
University of Hertfordshire – Mark Leyland  
University of the Highlands and Islands – Sean Mehan  
West Cheshire College – Anthony Beal

UCAS – Geoff Ramshaw

International contributions and discussion partners  
The Swedish Agency for School Improvement – Peter Karlberg  
University of Oslo, Norway – Dagfinn Begsager, Tore Hoel, Erlend Øverby  
University of Turku, Finland – Lassi Nirhamo

The services of external consultants engaged for the project have been second to none. For future projects, the XCRI team would have no hesitation in re-engaging the services of:

- APS Ltd – Alan Paull;
- Kainao.com – Ben Ryan;
- Phosphorix - Selwyn Lloyd;
- Simon Grant; and
- Paul Walk.

Last, but definitely not least, XCRI has benefited immensely from the close support of CETIS, particularly Scott Wilson, Vashti Zarach, Wilbert Kraan and Sam Easterby-Smith.

## APPENDIX B: EXAMPLE XCRI CAP INSTANCE

```
<?xml version="1.0" encoding="UTF-8" ?>
<catalog generated="2005-10-10T21:00:00" xmlns="http://xcri.org/profiles/catalog"
xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://xcri.org/profiles/catalog cap.xsd">
  <provider>
    <identifier>oucs.ox.ac.uk</identifier>
    <name>Oxford University Computing Services</name>
    <url>http://www.oucs.ox.ac.uk</url>
  </provider>
  <course>
    <identifier>TIUA</identifier>
    <title>PowerPoint Level 1: Fundamentals</title>
    <description>
      <div xmlns="http://www.w3.org/1999/xhtml">
        <p>This module shows how to modify and create Powerpoint presentations.</p>
      </div>
    </description>
    <description type="Syllabus">
      <div xmlns="http://www.w3.org/1999/xhtml">
        <p>This module shows how to take an existing presentation and modify it
          and how to create your own presentations. No knowledge of PowerPoint is assumed.</p>
        <p>The topics covered are:</p>
        <ul>
          <li>Using and modifying an existing PowerPoint presentation</li>
          <li>Creating a simple presentation</li>
          <li>Making use of themes and schemes supplied with PowerPoint</li>
          <li>The PowerPoint views</li>
          <li>Printing and saving your presentation</li>
        </ul>
      </div>
    </description>
    <qualification>
      <title />
      <level />
    </qualification>
    <presentation>
      <identifier>TIUA-100777</identifier>
      <start>2006-01-17T14:00:00</start>
      <end>2006-01-17T17:00:00</end>
      <studyMode />
      <venue>
        <identifier />
        <name />
      </venue>
      <placesAvailable>32</placesAvailable>
      <cost />
      <entryRequirements>No prior knowledge of Powerpoint is required.</entryRequirements>
      <applyUntil>2006-01-17T14:00:00</applyUntil>
      <applyTo>
        <identifier />
        <name>OUCS</name>
        <phone>(01865-2)73200</phone>
        <email>courses@oucs.ox.ac.uk</email>
        <url>http://www.oucs.ox.ac.uk/courses/detail.xsp?code=TIUA</url>
      </applyTo>
    </presentation>
  </course>
</provider>
</catalog>
```