

## RESEARCHING AND DEVELOPING VIRTUAL SCOTLAND - A PERSPECTIVE FROM THE CENTRE FOR DIGITAL LIBRARY RESEARCH

By

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### Abstract

*Scotland, with its Parliament recently re-established after 300 years, is likely to see the development of a networked service to make electronic information, learning and research materials readily available to all of its citizens as a key aim in the early part of the 21<sup>st</sup> Century. The newly-created Centre for Digital Library Research <sup>[1]</sup> at Strathclyde University <sup>[2]</sup> in Glasgow aims to be a significant player in the process of making the vision a reality, whilst also contributing to international research efforts in the area. Bringing the networked service of the future into being requires collaborative research and development effort in a range of areas - from identifying and documenting current problems and establishing future requirements, to work on major elements of the problem such as user needs and user interfaces, collaborative collection development, content creation and maintenance, interoperability problems, navigation and integration issues, access control, metadata, and standards and policy frameworks. The Centre is already working with stakeholder institutions, organisations and individuals across the country on a number of relevant projects and initiatives that will contribute to understanding and develop expertise in these areas. Many of them have a practical focus that will help to partially implement the kind of environment envisaged. Examples are GDL (the Glasgow Digital Library project), CVU (Clyde Virtual University project) <sup>[3]</sup>, CAIRNS (Co-operative Academic Information Retrieval Network for Scotland) <sup>[4]</sup>, SCONE (Scottish Collections Network Extension project) and DIO (Digital Information Office project).*

### 1. Introduction: digital libraries and digital learning for all - how do we get there from here?

With research into the issues surrounding the development of digital libraries and digital learning growing in volume and intensity across the developed world, the creation of a Scottish Centre for Digital Library research is a timely development, particularly since Scotland's recently re-established Parliament has been quick to recognise the importance of advances in this area to the economic health of the Nation and its citizens. Based at Strathclyde University in Glasgow, but already working with a large, growing and increasingly cross-sectoral range of institutions and organisations across the country on a number of co-operative projects, the Centre aims to conduct appropriate research with a sound theoretical basis, a focus on practical outcomes, and an understanding of the value of collaborative research in the current context. Over the last two or three decades, advances in information and communications technologies have made the vision of a society in which

information and learning material is readily - if not necessarily freely - available to all a realisable aim, if only in the more developed areas of the planet. For most workers in the field, it has long since ceased to be a question of if, or even when, but of how. *How do we get there from here?* A question which, in its turn, must be transformed into a growing series of ever more specific sub-questions, the answers to which will help direct our collective eye, hand and brain as we seek to shape the developing digital environment both globally and locally. The aim of the Centre for Digital Library Research is to contribute to international efforts in this area, whilst maintaining a particular emphasis on Scottish needs and realities, and on research with practical value in these contexts.

## **2. Means and mechanisms: the centre and its projects**

The Centre for Digital Library Research was formed in August 1999, with the aim of bringing together long-standing University research interests in the digital information area previously spread across two University departments: the University's Directorate of Information Strategy, which includes the Library and the Centre for Educational Systems<sup>[6]</sup>, and the Department of Information Science<sup>[7]</sup>. Key aims are to 'combine theory with practice in innovative ways' and be 'a centre of excellence on digital libraries issues ranging from information policy and information retrieval to document storage technologies and standards'. Although not made explicit, this is understood to encompass issues and materials relating to digital learning, with the Clyde Virtual University project being the centre piece of efforts in this area. Funding for projects managed by the Centre comes from the University itself and, in some cases, its partners, RSLP (Research Support Libraries Programme), Elib (The Electronic Libraries programme), SHEFC (the Scottish Higher Education Funding Council), JISC (the Joint Information Systems Committee) and the Scottish Office, with the following being a full listing at time of writing:

### **CAIRNS**

CAIRNS is based at the Universities of Glasgow and Strathclyde and aims to integrate the 25 Z39.50-compliant catalogues or information services of CAIRNS sites across Scotland into a service that allows the various distributed services to be searched as a whole or in geographical or subject groups. The intention is to provide a comprehensive union catalogue for Scottish HE without the cost and effort of setting up and maintaining a central database, together with a set of smaller specific sub-sets of this catalogue appropriate to particular purposes (e.g. a particular subject interest) and a means of supporting the ongoing commitment to improving cost-effectiveness through co-operation and resource-sharing. The existence within the clump of servers describing and delivering electronic resources will also enable a limited amount of investigation of cross-domain implications, particularly in respect of CAL packages. The project has three members of staff, with the Project manager and clerical assistant based at Glasgow University and the Technical Support Officer based at Strathclyde. The project will take advantage of the SCURL (Scottish Confederation of University and Research Libraries) WWW/Z39.50 conspectus-based RCO (Research Collections Online) service as the basis of a subject-based dynamic clumping service. This will provide users with a means of navigating intelligently within the CAIRNS distributed catalogue by dynamically generating subject-based sub-clumps of catalogues to search via Z39.50. For further information see the CAIRNS web-site<sup>[4]</sup> and the CAIRNS gateway<sup>[8]</sup>.

## **SCONE (Scottish Collections Network Extension project)**

SCONE is an RSLP-funded project which aims to aid researchers by extending existing collaborative collection management work carried out within the SCURL framework into new areas and investigating effective models for building and sustaining a co-ordinated Scotland-wide distributed national resource. This would be conveniently accessible to researchers via the CAIRNS distributed catalogue, the Research Collections Online based dynamic clumping service, and SCURL inter-access policies. In addition to enhancing existing online assistance to help researchers identify relevant collections, the project will also aim to provide online information and other facilities to assist library staff in jointly managing collaborative collection management processes in order to get the best out of limited national resources. SCURL's approach to collaborative collection management is based on identifying and recording collection strengths and weaknesses, making this information readily accessible to contributing libraries, and jointly agreeing an approach to sustaining the strengths and addressing the weaknesses. The project will also aim to evaluate this approach with a view to identifying mechanisms for improving its effectiveness. In addition, SCONE will seek to extend RCO data to cover research level collections in the 'new universities' and HE institutions in Scotland, datasets identified in the Scottish Datasets project <sup>[9]</sup>, research related electronic resources identified in the CATRIONA II (Nicholson 1999, p247) project <sup>[10]</sup>, and a range of other material. In a related initiative, also intended to enhance the RCO database, SCURL has recently successfully applied to SOEID (the Scottish Office Education and Industry Department) for additional funding to mount RCO data not currently online, to establish and agree an effective, low maintenance, and possibly distributed, mechanism for keeping the data current, and to investigate extending the data to include collections in public libraries. For further information see the SCONE bid document <sup>[11]</sup>.

## **GDL**

The Glasgow Digital Library is a city-wide initiative funded initially by the Research Support Libraries Programme. It aims to create a wholly digital library to support teaching, learning and research at all levels in the city. The project aims significantly to enhance existing collaboration within the City of Glasgow and to explore the potential of Clydenet (the local Metropolitan Area Network) as a delivery vehicle for content. There is already significant interchange of users between the partners (Glasgow, Glasgow Caledonian and Strathclyde Universities, the Glasgow Tele-colleges Network institutions, and Glasgow City Council Libraries and Archives) and the project will identify, create, mirror and purchase content of common interest to some or all of the partners to create a collaborative, cross-sectoral, digital collection of resources that will be of significant value, both to researchers in the Clydenet area, and to researchers elsewhere with an interest in Glasgow-oriented or Glasgow-based research collections. The particular lessons to be learnt are expected to be in shared digital collection management within a large metropolitan area, the management, distribution and accessibility of locally created, stored or purchased resources, and in the use of the Metropolitan Area Networks in these contexts. A key aim is to create a MAN-based Digital Library service and demonstrator based on shared collections and a co-operative approach to collection development and management. This will be of value both in itself and as a model for other MANs. Integration with CAIRNS will allow inter-MAN issues to be explored. With the SCONE RSLP project also based at the Centre, useful lessons should also be learnt on the inter-relationships between MAN-based (GDL) and national (SCONE) collaborative collection management programmes. The joint digital library will be based initially on electronic resources created by the institutions, on public domain information, and on joint purchases and digitisation initiatives, but the longer-term aim will be to establish the GDL as a virtual co-library of the majority of public institutions in Glasgow and the Librarian

will be expected to play a key role in this process. For further information see the bid document.<sup>[12]</sup>

### **GAELS (Glasgow Allied Electronically with Strathclyde)**

GAELS is a pilot project based at the Universities of Glasgow and Strathclyde, and funded by the Scottish Higher Education Funding Council. It has two principal aspects. It is a practical project aimed at improving joint access to electronic information services and resources for postgraduate students and staff researchers, and to provide joint WWW-based training materials for postgraduate students. Secondly GAELS has a research function, to investigate problems and issues in the joint provision of such services. The pilot project is examining the provision of these services within the engineering faculties at the universities. The longer term aim is to extend collaborative services and training to all faculties in the two universities. For further information see the GAELS web-site.<sup>[13]</sup>

### **DIO (Digital Information Office)**

The Digital Information Office is a new division of the Directorate of Information Strategy responsible both for the professional management of electronic resources created within the University and the co-ordination of University wide interest in commercially acquired electronic information resources. The DIO will work with other areas of the University, including the Library and IT Services, to create a metadata repository and associated web-based service interface for the University's electronic resources, including the integration of the local service with the Glasgow Digital Library, CAIRNS and aspects of SCONE (other CDLR projects). Additional tasks will include the development, maintenance and dissemination of policies and standards associated with the creation, description (metadata), storage, organisation, maintenance, security and copyright of digital information, together with the design of training for departmental information managers and the provision of advice on commercial or strategic exploitation possibilities for locally created resources. For further information see the CATRIONA II web-site.<sup>[10]</sup>

### **CVU**

Clyde Virtual University is a joint venture to develop and deliver Internet-based teaching materials to students at five institutions in the West of Scotland. Founded in 1995 as Europe's first virtual university, CVU combines the academic and technical strengths of Glasgow, Strathclyde, Glasgow Caledonian and Paisley Universities together with the Glasgow School of Art. CVU brings together custom-built tools and materials such as virtual reality educational worlds, online assessment and automated marking, desktop video conferencing, text-based discussion forums and a state of the art virtual library in a unique infrastructure for the provision of education over the Internet. CVU is based at the Strathclyde University Centre for Educational Systems.

### **Policy Approaches to IPR (Intellectual Property Rights)**

The JISC funded study on IPR aims to identify the issues and problems concerning IPR found in HEIs (Higher Education Institutions) and make practical recommendations which HEIs could reasonably be expected to implement. The focus is on copyright, particularly for material in or converted to electronic form. It will do this first by surveying HEIs in the UK and establishing current approaches to the ownership and control of IPR, followed by visits to institutions and organisations. The topic cuts across different functional domains of universities and the study will cover the following areas: IPR in teaching and learning materials; IPR Issues concerning research e.g. publishing of research results on the Internet; IPR Issues concerning terms and conditions of contract and governance. The study

is based at the Strathclyde University Centre for Educational Systems. For further information see the web-site <sup>[14]</sup>.

### **The BUBL Information Service**

BUBL<sup>[15]</sup> is an Internet-based information service for the UK higher education community which also offers a specialist service to librarians and information specialists. Operating from the University of Strathclyde, BUBL is accessible via the world wide web and is also accessible via Z39.50 at link.bubl.ac.uk, port 210, database Zpub. BUBL had 9.4 million accesses in 1998-99, and has users in 167 countries. Its major services are the BUBL Link/5:15 Internet resource catalogue; BUBL Journals; BUBL UK; BUBL News; BUBL Search; BUBL Mail; BUBL Internet archive; and Acqlink. BUBL is not an acronym. When BUBL was first established in 1990 the name stood for BULLETIN Board for Libraries. However it is now known as the BUBL Information Service, or BUBL for short.

### **3. Forward paths: getting 'there' from 'here'**

Taken together these projects form an inter-related and to some extent integrated set of initiatives covering a range of key issues relating to digital libraries and digital learning in 'virtual Scotland', contributing to the task of providing answers to the question 'How do we get there from here?' in the following ways:

#### *3.1 Defining and Describing 'There': Digital Scotland*

Drawing on the experience gained from some of the projects described above, a member of CDLR staff recently contributed to the work of SAGIA, the Scottish Library and Information Council's Advisory Group on Interoperability and Access, set up to advise the Scottish Parliament's Advisory Group on 'Digital Scotland' on issues relating to interoperability and access. An early version of the interim advice document created by this group suggested that the aim in attempting to create a digital or virtual Scotland should be:

*'a coherent and integrated networked electronic environment in which Scottish citizens can:*

- *Reliably discover, locate and retrieve electronic teaching, research and public information materials appropriate to their needs and level of educational development at any particular point in their lives*
- *Do this through a common user interface equally adaptable to different needs and educational levels*
- *Utilise the same common interface to access and fully interact with any such materials without diminution of presentation or function caused by the artificial barriers of variant formats and protocols*
- *Readily use, interact with, and assimilate the content of the materials themselves with minimal prior instruction and training through the use of a limited set of standard navigation icons and instructional tools*

*and in which Scottish enterprises, institutions, organisations and citizens can:*

- *Readily contribute to the development of materials and services themselves by working within the framework and associated standards*
- *Be assured of compatibility with developing international standards in areas of interoperability and access'*

Once complete, the document will also indicate what is required to bring this 'coherent and integrated networked electronic environment' about - drawing upon recently completed, ongoing, and projected projects and initiatives both within and beyond Scotland to specify appropriate standards, areas requiring research, development, remedial, or 'kick-start' funding, areas requiring further discussion and agreement, and so on as appropriate. The current version of this developing document is available.<sup>[16]</sup>

### **3.2 Researching and describing 'Here'**

Of course, knowing the ultimate destination is only one key element in the determination of how to go about getting there, another is knowing the place or places of origin well enough to understand the nature and path of the 'journey' that is likely to be required to reach the hoped for destination. Projects and initiatives whose work is relevant here range from past projects such as CATRIONA II and Research Collections Online, through ongoing work such as CAIRNS and SLAINTE (Scottish Libraries over the Internet)<sup>[17]</sup> to new and developing initiatives such as SCONE and PAIRTS (Public Access to Information, Research and Teaching in Scotland).<sup>[18]</sup>

#### **Content Creation, Maintenance and Description: Problems and Opportunities**

Although it pre-dates the creation of the CDLR, the CATRIONA II project played a key role in identifying problems and opportunities existing within Scottish Universities relating to the creation, maintenance, management and exploitation of quality electronic teaching and research resources. It is also the pre-cursor of the forward-looking Digital Information Office initiative. CATRIONA II investigated questions relating to the university management of locally-created electronic resources from a UK-wide perspective, but within the context of surveys and discussions carried out in Scottish universities. It found that quality electronic teaching and research resources, of significant value or potential value to academics, universities, and the UK Higher Education community in general, were being created at high levels in all types of university. However, since they were not being created with the aim of wider access and use, the materials were mostly not networked, difficult to find, or in difficult to access electronic formats, when they were, and – at least in respect of teaching resources – unlikely to be suitable for reuse by other institutions or even other departments in the host institution. Other common problems were a lack of clarity on the copyright position of resources on university web-sites and a failure to protect potentially valuable university resources from copyright infringement. University management of services offering access to these resources within and beyond the host institution was identified, both as a way of improving the situation so as to extract the maximum value from such material and the effort that goes into creating it, and as a significant step in the practical implementation of institutional Information Strategy in the key areas of teaching and research. Subsequent to the project, Strathclyde University set up a Digital Information Office with the aim of implementing these findings and dealing with a range of associated issues.

A key unanswered question is the extent to which the project findings within Universities are transferable to other environments where teaching materials in particular are or may be created - in Schools, for example, or in the workplace, a question likely to be tackled to some extent when the DIO begins to work with the various participants in the Glasgow Digital Library project and in the context of Glasgow's 'Learning City' initiative.

#### **Identifying Barriers to Inter-Operability: Cataloguing, Indexing and Z Attributes**

As indicated earlier, the CAIRNS project aims to set up and develop the basic core of a distributed union catalogue for Scotland. As part of this effort, it has begun to document various barriers to full interoperability existing in the core CAIRNS libraries (13 Universities, the National Library of Scotland, and East Dunbartonshire Public Library). These fall into the

categories of cataloguing problems, indexing problems, and problems with the behaviour of Z server and Z clients utilised in the libraries, problems that are expected to be reflected and amplified in the Scottish libraries currently beyond CAIRNS.

For example, the following cataloguing and indexing problems have been identified:

- Sites where the whole stock is catalogued and others where it is only partially covered
- Sites using UKMARC, sites using USMARC, sites using other schemes that map to UK or US MARC, and sites using a mixture of these and other 'home-grown' formats
- Sites using one subject scheme, sites using other schemes, and sites using no scheme at all - along with similar differences in the use of class schemes
- Sites using separate author, title and subject keyword indices and sites offering combined keyword indices
- Sites indexing two MARC fields in their author indices, whilst others index 6 or 9 or 12 fields, with similar divergent practices in other indices
- Sites recording and indexing full author surnames and forenames, and sites recording and indexing only surnames, with similar discrepancies in all indices.

The reasons for these differences are historical. The catalogues were developed, not with the aim of interoperating within a distributed union catalogue, but with the aim of serving local user groups, in local circumstances. The effect of the difference, however, is poor interoperability - which is to say that the results obtained from searching the virtual catalogue are not as good as they would be if you were searching one single coherent union catalogue with standardised data. For example:

- Failure to retrieve hits in a given catalogue on an author search can mean either that the library has no items by that author, or that it has but the items have not been catalogued yet, or that it has but that this particular library catalogue will show author hits for surname searches only and show none if the forename is included in the search
- Failure to retrieve hits in any given catalogue for a subject search can mean either that the site has nothing on that subject, or that it has but has no subject index, or that it has a subject index but does not use that particular subject term, or that it has but that its older records don't have subject terms in them
- Finding twice as many hits in one catalogue than in another on a title keyword search may mean that the catalogue holds twice as many relevant items, or it may just mean that the other catalogue does not index as many potentially relevant fields.

CAIRNS has detailed information about these problems in the existing CAIRNS libraries and also plans to investigate the resultant effects on catalogue performance. It is also charting problems with variant and non-standard behaviour of Z servers and clients in the clump and the resultant effects of these on performance. The identification of problems like these - likely to be barriers to the introduction of the kind of Scottish networked environment described by SAGIA (see 3.1 above) - is recognised as being vital to the successful implementation of such an environment and to identifying the mechanisms necessary to bringing it about.

### **Navigation and Collaborative Collection Development in a Distributed Catalogue**

A key element in the description of 'here' as far as the beginnings of a virtual Scotland are concerned is the Research Collections Online database created under the auspices of the Scottish Confederation of University and Research Libraries. This is important because:

- It describes collection strengths in the eight older Scottish university libraries, the National Library of Scotland, and the two largest public libraries (The Mitchell in Glasgow and Edinburgh Central Library) utilising an adaptation of the RLG (Research Libraries Group) Conspectus methodology
- It is seen as the key to navigation in a distributed Scottish union catalogue and is already part of the dynamic clumping mechanism that is at the heart of CAIRNS.<sup>[19]</sup>
- It is seen as the heart of collaborative collection development between Scottish institutions in the future.

Work within CAIRNS, including discussions with SCURL, SLIC, SLAINTE and others has identified a number of barriers to forward movement in these areas based on the current RCO:

- The need to expand coverage significantly to encompass all elements of a future Scottish union catalogue
- The fact that the original methodology employed to measure collection strengths is considered too labour intensive
- The fact that the original Conspectus subject scheme is unlikely to be popular with the many other institutions whose catalogues will become part of a Scotland-wide distributed catalogue.

These will all be tackled over the next two years within the SCONE project, in conjunction with other key players such as SLAINTE, SCURL, SLIC, SCRAN<sup>[20]</sup>, NGfL (the National Grid for Learning (Scotland))<sup>[21]</sup> and SUFI (the Scottish University for Industry)<sup>[22]</sup>.

In addition, the effectiveness of the mechanism to support intelligent navigation has yet to be evaluated, a task to be carried out within CAIRNS in the first half of the year 2000, the aim being to more fully identify requirements for helpful navigation.

### **Expanding the Cairns Distributed Catalogue**

Although the CAIRNS project aims initially at bringing no more than 25 services into the clump at most, its long term aim is to encompass all major Scottish catalogues in an intelligent and integrated way. Some of the problems likely to be encountered in this enterprise have already been covered above. One which has not, but which has been identified by CAIRNS as a key issue, is the problem of handling non-MARC record formats. Currently, the CAIRNS gateway software can only deal with US or UK MARC records or 'OPAC' records. At least one important service - SCRAN - sends out GRS-1 records. In addition, it is possible that new services will come into being that will send out Dublin Core records or IMS records. If CAIRNS is to grow, a means of improving the software to encompass these formats or of changing it for new software must be found.

#### *3.3 How: Linking Users and Content in a Standards Based Environment*

Bringing virtual Scotland into being - getting from 'here' to 'there' - requires work in a number of areas:

- User needs and user interface design
- Content creation, development and maintenance
- Inter-operability, navigation and integration, access, and metadata
- Standards
- Policy

The aim of the Centre is to have a portfolio of projects that give it experience of all of these areas and allow it to contribute to the resolution of the various issues they raise - recognising, of course, that success will depend upon the work of many other groups, institutions and individuals, and that collaboration is a vital element in the programme. The current portfolio could be stronger in some of these areas, but largely meets this aim, with CDLR staff involved to some extent in all of the areas listed.

### **User Needs and User Interfaces**

A user in virtual Scotland might be almost any age, of any social and educational background and of any of a possibly infinite number of interest groups and developmental levels. Their needs in respect of information and learning are likely to vary greatly. The nature of their needs in respect of interface facilities, approach and terminology provided by both services and resources (e.g. teaching packages) may also vary greatly. Equally, it is possible that one or a few basic approaches will suffice in this respect. Not enough is known about these and other user-related issues. Significant additional research is required to provide the hard data required to inform decisions regarding interface design, detailed metadata requirements, needs and priorities as regards content, and decisions regarding the extent and nature of any need there may be to utilise user profiles to influence service and resource presentation.

In the absence of a major programme or programmes to investigate this area, the CDLR will aim to obtain illumination and experience of such issues from a range of projects whose scope is more general but whose primary focus is serving users:

- Although intended initially for researchers only, the long term aim of the Glasgow Digital Library is to serve all of the citizens of Glasgow - which is to say, that its users too are likely to be of almost any age, of any social and educational background and of any of a possibly infinite number of interest groups and developmental levels. Although it has no significant funding for user studies, it will conduct user evaluations of its interface and attempt to collect data on users from its members who represent a wide range of user groups. It will also aim to find funding to conduct significant research on user needs.
- User interface design is a major element of CAIRNS and, to a lesser extent, of SCONE. Within both projects, moreover, there is a recognition that navigation within the catalogues of virtual Scotland using the CAIRNS dynamic clumper is dependent as much on knowledge of users as it is on knowledge of collections and collection strengths. Both projects have elements which aim at user evaluation of the CAIRNS interface. CAIRNS will also work with GDL on integrating the CAIRNS national interface with the GDL regional interface
- Clyde Virtual University has significant experience of working within and designing virtual learning environments and also of resource design and continues to work in this area. It is currently working with the Glasgow Development Agency on its 'Learning City' agenda, work likely to be relevant to the GDL
- One aim of the Digital Information Office is to create a metadata repository and associated web-based service interface for the University's electronic resources, including the integration of the local service with the Glasgow Digital Library and CAIRNS
- BUBL has produced an innovative interface to its BUBL LINK service which aims to be usable with minimal training (e.g. all subject terms are known to users before they search). It has also developed automated methods of monitoring user behaviour which may be of value to the above projects and to others.

## **Collaborative Collection Development and Content Creation and Maintenance**

Involvement in issues relating to content - whether it be information service content, learning resources and environments, or research materials and data - ranges from research into and support for collaborative collection development activities in libraries, through the creation and maintenance of electronic teaching and research materials, to innovative approaches to the collaborative purchase of electronic materials, with the following being an illustrative summary of activities:

The Glasgow Digital Library aims to develop the content of its joint digital library for all inhabitants of the City by:

- Identifying resources that might usefully be digitised and seeking funding from a variety of sources to support and develop its digitisation plans
- Encouraging and supporting the creation of electronic teaching, research and information materials in City educational institutions in conjunction with the Digital Information Office project
- Investigating the potential for reducing the costs of subscribing to commercial electronic products by negotiating city-wide licenses
- Mirroring heavily used Internet resources locally.

It will also develop joint maintenance arrangements for digital resources and aims to provide a model for other metropolitan area based digital libraries in Scotland and elsewhere.

The Digital Information Office will aim to encourage the creation of electronic teaching and research materials at Strathclyde University and to encourage standard approaches to its creation that will enable it to be reused both across the University and beyond it. It will also manage a service to handle access to the material, and to protect and maintain it and work with other institutions, particularly in the context of the Glasgow Digital Library project, to encourage similar approaches elsewhere. It will also work with the JISC IPR Study project to develop agreed approaches to managing intellectual property rights in respect of such materials.

The SCONE project has a range of deliverables which aim to support collaborative collection development efforts in Scottish universities. These include:

- Providing web-based tools to support collaborative collection development efforts
- Expanding the range and type of collections described in the RCO database of Scottish collections
- Examining alternative methods of measuring collection strengths in libraries with the aim of making this more efficient and less labour intensive
- Working with cross-sectoral groups in Scotland on an agreed subject scheme for describing important collections.

The Clyde Virtual University project is working on the collaborative creation of electronic teaching and learning materials with the four local universities and other city educational establishments (e.g. the Glasgow School of Art), with the materials presented to users in a jointly developed electronic learning environment. It is working with the Glasgow Development Agency to develop a suitable learning environment for its 'Learning City' agenda. Its activities parallel those of the Glasgow Digital Library and it is expected that the two projects will work to integrate their activities. There is an extent to which the Glasgow

Digital Library will be the library for the Clyde Virtual University, although the exact relationship needs to be investigated and discussed.

The GAELS project has developed considerable expertise in brokering agreement between Glasgow University and Strathclyde University in respect of collaborative collection development in the Engineering area. It has also been active in the creation of jointly produced and utilised learning materials. Its expertise will continue to be developed over the coming year and will also help inform the work of the Glasgow Digital Library project in these areas.

### **Inter-Operability, Navigation and Integration, Access, and Metadata**

The environment in which Scottish citizens will interact with networked resources across the country and beyond it is and will increasingly be a complex one. It is, however, essential that this complexity be largely 'hidden' from the users themselves. They should be able to navigate their way to the resources relevant to their needs speedily and with ease. The environment that they operate in must be flexible, with the underlying complexity this implies, but it must also be straightforward to use and adaptable to the needs of a range of user groups. Application of the standards covered in the next section is one key element in achieving this end. The other key element is practical expertise in understanding, developing and managing the environment itself based on research that encompasses its complexity. This element is addressed partly by individual projects - in particular CAIRNS and SCONE - and partly by the interrelationships between such projects and others like the Glasgow Digital Library and the Digital Information Office. Between them they encompass both a need and an opportunity to understand inter-operability, navigation and integration, access, and metadata issues at and between institutional, regional, national and international levels, as follows:

**Interoperability** between catalogues is an essential requirement in this distributed environment and is assumed to be built upon broadcast searching via Z39.50 (although BUBL is also looking at other protocols such as LDAP). The key projects here are CAIRNS and SCONE which, between them, are investigating the following interoperability issues:

- Interoperability problems between CAIRNS sites caused by differing cataloguing practices and variations in the quality or completeness of such data
- Interoperability problems between CAIRNS sites caused by differing indexing practices
- Interoperability problems between CAIRNS sites caused by differing and sometimes non-standard implementations of Z39.50
- Long term plans for dealing with such problems, such as aiming to implement the Bath Profile and change cataloguing and indexing practices as and when opportunities arise
- Short term mechanisms for circumventing such problems, such as identifying and implementing ways of sending different versions of a user search to different catalogues to overcome the problems caused by variant practices
- Anticipated cross-sectoral and cross-domain problems, such as the use by some services likely to form an essential part of a future distributed union catalogue for Scotland of record formats not supported by the current CAIRNS gateway, an example being the use of the GRS-1 format used by the SCRAN service
- Questions relating to the interoperability of a Scottish distributed union catalogue with a UK distributed union catalogue and similar catalogues in other countries, including those associated with interoperability between collection level description databases used for navigation purposes.

However, interoperability is also a key concern in the equally complex distributed environment envisaged by the Glasgow Digital Library and the GDL aims to work with CAIRNS and SCONE to address not only interoperability issues within the Glasgow Digital Library but issues relating to accessing the wider domain covered by CAIRNS from the Glasgow Digital Library domain and, possibly, vice versa. It is also probable that there will be a need to ensure inter-operability between catalogues covering different types of materials at institutional level in some cases.

**Navigation** between levels - from departmental up to international and international down to departmental - is a concern in all of the service oriented projects. Clearly, it is essential that the user be able to navigate easily from departmental pages to institutional pages to pages and databases in the local library, the institutional digital library, the metropolitan area digital library, CAIRNS, and beyond. This requires a common approach to design and a coherent approach to **integration** between services and projects and is recognised as an issue to be tackled jointly. In CAIRNS and SCONE, navigation is effected through the use of the CAIRNS dynamic clumper which uses a database of collections strengths organised by subject to guide users to sub-groups of catalogues in the total catalogue appropriate to a particular user enquiry. It could also be adapted to utilise user profiles, geographical considerations and other data for similar navigational purposes. It is possible that dynamic clumping or a development of it may help address similar issues within the institutions and within the Glasgow Digital Library and even that the ability it has to offer users different views of the network might be used one day to generate from base data alternative service views - institutional, Glasgow Digital Library, CAIRNS and so on.

**Access** and access control is also an issue for all service-oriented projects. As the digital resources available increase, the picture in terms of access rights and charges will become more complex. Any given resource may be freely accessible and fully re-usable to some users, freely available on a read only basis for others, accessible at a range of costs depending upon status or associations to others, and not accessible at all to some. This is certainly likely to be true at a Scotland-wide level. It will probably also be true to some extent and in some instances within the Glasgow Digital Library. And, whilst it is less likely to be true within institutions as regards institutional users, it is nevertheless certain to be an issue in respect of protecting institutional material from unauthorised external access. Very little work has been done on this as yet, but it is recognised as an issue for the future within the Digital Information Office, the Glasgow Digital Library, and CAIRNS. It has already been addressed to some extent within the Clyde Virtual University project where valuable teaching and learning materials have to be accessible to some but protected from the world at large. One issue to be looked at is whether the method employed in the CVU can be transferred for use in the other projects or whether a cross-sectoral Scotland-wide or UK-wide service is more likely to be appropriate.

**Metadata** issues are, of course, a key concern in all of this and are likely to be much discussed both within and between projects. Many of the most difficult to resolve interoperability issues identified within CAIRNS relate to incompatibilities between institutions in respect of legacy catalogue data, and metadata is, inevitably, a key concern in the proposed standards framework described in the next section. The projects portfolio of the CDLR provides a rich environment for the identification of metadata issues and an examination of how the issues relate to the standards and vice versa, with the following already identified as areas that require discussion and resolution:

- Can major catalogues like that of the National Library of Scotland be utilised to reduce the cost and effort involved in clearing up metadata based interoperability problems in CAIRNS, including those related to material that is not as yet catalogued at all?
- How can metadata standards in a distributed environment be maintained and monitored?

- Can resource creators such as academics in departments provide adequate, quality, standards-based, cross-compatible metadata for the resources they create or will relying on this mechanism inevitably create interoperability problems?
- Can different organisations serving different user groups agree a common subject scheme that will meet all of their varied requirements (with structured and controlled variations)?
- Is it necessary for metadata covering different types of material to utilise different metadata formats given that most Z39.50 software can only handle a subset of the possible formats?
- How can collection level description metadata best be maintained?

### **A Standards Framework for Virtual Scotland**

The CDLR contribution to SAGIA was mentioned earlier, Amongst other things, SAGIA aims to set out and advise on a standards framework for virtual Scotland. This will entail identifying appropriate standards, preparing guidelines for best practice, identifying areas requiring further research and development, and a range of other appropriate activities under the following headings:

- The Z39.50 standard
- Metadata and catalogue record formats
- Metadata and cataloguing and indexing practices
- A common scheme for describing the subject strengths of collections
- Securing access, authentication and user profiles
- User interface issues
- Electronic format standards
- Resource and service design standards
- Guidelines on intellectual property rights management.

The addition of further headings as the work proceeds is not ruled out. The Centre's portfolio ensures that it is well placed to make useful contributions to all of these areas. Other participants include SLIC themselves, CIGS (Cataloguing and Indexing Group Scotland), NGfL (Scotland), SCRAN, GTN (Glasgow Telecolleges Network), SUFI.

### **Policy Issues: A Policy Framework for Virtual Scotland?**

From user issues, to network hardware and architecture, to content and search and retrieve issues, all of the elements of a networked information service supplying digital information, learning resources and research materials and data to Scotland's citizens have a policy dimension. This fact is reflected in many of the projects described above. Thus:

- The Glasgow Digital Library project is not just concerned with creating content and making it accessible in an organised way but with the creation of a management structure and policy framework that will allow the concept to be developed and maintained into the long-term future
- Informing and raising key issues with policy makers is a significant element of the CAIRNS and SCONE projects
- The Digital Information Office project aims to influence and shape University policy and strategy in ways that will help foster the creation of electronic learning and research materials in the institution

Involvement in policy considerations and discussions at project level helps ensure that the CDLR will be well-placed to contribute usefully to discussions on this front in a Scottish context if invited to do so. Indeed, it already does so to some extent in the context of CAIRNS and SCONE. One possible additional forum for discussing such issues and contributing to higher level discussions is the meetings of the SLIC Advisory Group on Interoperability and Access described above which may well become involved in discussing and making recommendations of a policy framework as a natural extension of its standards work.

## Conclusion

Bringing about a virtual or digital Scotland in which Scottish citizens have readily available access to all of the electronic information, learning resources and research materials and data they require is a realisable aim, but a good deal of research and development work is needed before it becomes an operational reality. Working with a range of organisations, institutions and individuals across the country on a range of projects that allow it to investigate and develop expertise on key issues such as the problems of the current networked environment, the likely nature of the future environment, and the various elements that will help shape it and bring it into being (User needs and user interfaces, Collaborative Collection Development and Content Creation and Maintenance, Interoperability, Navigation and Integration, Access, and Metadata, Standards and Policy), the newly-created Centre for Digital Library Research at Strathclyde University is already making a significant contribution to this process, although it is far from being the only player in this field. Many of the projects - in particular CAIRNS and SCONE and the Glasgow Digital Library project - focus on practical outcomes that in themselves will help to partially implement the kind of environment envisaged.

## References

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## End Notes

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3. <http://cvu.strath.ac.uk/>
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5. The Directorate of Information Strategy, managed by the Librarian and Director of Information Strategy, Mr Derek Law, integrates the following, previously separate departments within one directorate: Audio Visual Media Services, the Centre for Educational Systems, the Information Strategy Office, Information Technology Services, Information Systems Administration, and the University Library
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